ELECTRICAL REVIEW

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Testing Light and Power Systems While Active—C. H. Rudd's System.

There are many stations, both arc and incandescent, which are so constantly in service that to stop the generator for the purpose of testing insulation or conductivity is next to impossible, because of the resulting inconvenience to consumers. This is especially true of central station lighting plants and railway or other power plants which know no stops save such as are made imperative by accident. Still it is necessary that tests be made, and there is always a struggle between the advocates of duty on the one hand and of inclination on the other in the matter.

Mr. C. H. Rudd, of the Western Electric Company, Chicago, who for the past two years and more has experimented almost constantly in this field, has enabled the REVIEW to lay before its readers a very complete and reasonable method of accomplishing the measurement of insulation, and determination of the fault where one exists, while the line is in active service. The system by which this result is accomplished is extremely simple, and with the aid of the accompanying diagrams will be readily understood. Not only while in perfect condition but with a fault in the insulation of a plant as well, there is always a neutral point, an "electrical center," where the fall of potential is practically *nil*. Mr. Rudd, with this fact in view, has arranged an artificial circuit formed of resistances. The main circuit, in operation, is shown in the upper half of Fig. 1, the lower half being the artificial resistances between which are plug holes for connecting the galvanometer circuit. By depressing the key connecting the latter instrument to ground as shown in Fig. 2, and feeling with the connecting plug, the electrical center may be found, when the needle rests at zero.

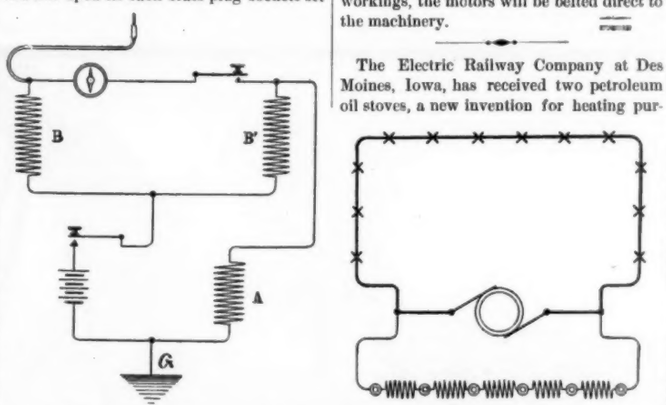
Now having found the electrical center of the line, the plug remaining inserted, the amount of insulation resistance is readily determined by the bridge method, as shown by the connected diagrams, where B, B_1 and A are the three known variable resistances, and the live circuit is the unknown or X.

The resistance coils in Fig. 1 are, in the set which has been in constant use in Chicago for some months, 100 in number, of 2,000 ohms each. In the ground branch to prevent possible accident, a heavy resistance is introduced at G.

Circuits measured by this method while in action, and subsequently shut down and measured by ordinary galvanometer methods or the bridge, have invariably shown the correctness of the Rudd system.

It will be readily seen, too, that a ground fault may be located with very considerable accuracy—sufficient for practical purposes by the same method.

In Fig. 3 is presented a view of the ground alarm as it appears in the central station of the Chicago Arc Light and Power Company. It shows a case of wood, on the face of which is a series of telephone drops in combination with switches for making proper connections. The wires shown at the top of the case are branches from the plug sockets, which form the terminals of the various circuits in the main switchboard. There is a one ampere fuse in the circuit of each of the branches, so that accidents in the alarm case need not endanger the dynamos. The vital part of the system is in the condensers, which are located within the case. The condensers have a capacity of one microfarad each, and there are two of them to each main circuit. One pole of one condenser runs to a plus pole of a circuit, and one pole of another condenser runs to the minus pole of the same circuit. The free poles of the two condensers join in a common circuit through a telephone drop to ground. When the main circuits are properly insulated and running smoothly, the drops are not disturbed, but a sudden fall of insulation in one spot unbalances the charge in the condenser if the fall be considerable. The action in the condensers energizes the drop magnet, which releases the drop shutter. The falling of a shutter rings a bell, which is connected to be operated by the fall of any one of the shutters. At the top of the case will be seen a narrow board in which are two rows of holes. The board is of hard wood, and has upon its back brass plug sockets set



FIGS. 1 AND 2.—DIAGRAMS ILLUSTRATING THE RUDD GROUND ALARM.

to coincide with the holes bored through the board.

The purpose of this arrangement is that the attendant may not thoughtlessly come in contact with the sockets. These sockets form the terminals of the alarm branches, and, as already stated, are in direct contact with running circuits. The sockets are placed in the system for the purpose of furnishing the attendant ready means for the use of measuring apparatus.

Upon a shelf near by is a box containing 100 spools of german silver wire of 2,000 ohms each. These spools are connected in series, and altogether measure 200,000 ohms. Brass sockets are placed in the series of spools so that branch connection may be made anywhere to the circuit between the spools. This high resistance is arranged to be connected across the poles of a circuit by means of cords and plugs connected with the sockets at the top of the board, and its object is to facilitate the measurement of a circuit while the lighting current is in action.

Electric Motors in Africa.

Electric mining apparatus has been ordered of the Sprague Electric Railway and Motor Company, to go to the Transvaal, South Africa. It is intended to transmit 140 horse-power over a distance of three miles, the source of the power being a waterfall at that distance from the gold mines. At the workings, the motors will be belted direct to the machinery.

The Electric Railway Company at Des Moines, Iowa, has received two petroleum oil stoves, a new invention for heating purposes. The inventors claim for them safety and the most satisfactory and cheapest heat appliances for cars. The stoves are placed underneath the seat, are entirely out of the way, and if satisfactory in their operation will certainly prove a big improvement over the car stoves. The invention is a new one, the patent having been secured by a Chicago firm, who have given them a thorough test. An agent of the company is in Des Moines, and the heaters will be placed in a couple of the electric cars and given a test. If satisfactory the common stoves will be dispensed with and the new invention placed in their stead.

Sherman, Tex.—The Sherman and Denison Electric Railway and Power Company is organized with capital stock of $300,000. Mr. N. M. Lee was elected president of the company.

Electric Plant Specifications for the Brooklyn Navy Yard.

Commodore Royal B. Bradford, the inspector of electric plant and devices for the Navy, has completed the specifications for the plant to be used on the receiving-ship, "Vermont," in Sailors' Hall and in other buildings in that part of the Navy Yard, and they have been sent to the Navy Yard by Commodore Dewey, chief of the Bureau of Equipment. The specifications provide that the engine shall be of sufficient size to develop 30 horse-power with steam pressure at 60 pounds, and that the dynamo shall be of the shunt-wound type, of a capacity of not less than 20,000 volts, and of a voltage not less than 110 nor greater than 120 measured at the poles, and must be supplied with every article necessary to its efficient operation. Undue sparking, with consequent wearing away of commutator bars, will not be tolerated. One ampere meter and two voltmeters of a thoroughly efficient type for use on shore must be supplied. The specifications call for 14,000 feet of wire, and provide for the strength of their conductivity and the nature of the insulation required to make all runs absolutely safe. The voltage of the lamps is not to be more than 113. The lamps are to be of the best quality, having a life of not less than 600 hours when operated at full power; must not vary in resistance more than one ohm from the standard, and must be interchangeable in all sockets, and must be marked with candle-power, voltage and resistance. The exterior metallic parts of junction boxes, switches, receptacles and sockets are to be of Tobin bronze, and no iron or steel is to be used in their construction. The delivery of the materials must be made within 30 days after the contract is signed.

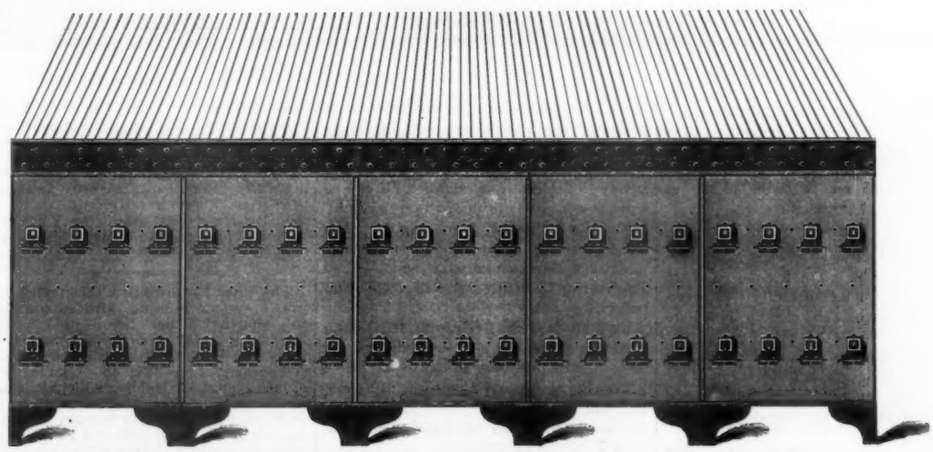


FIG. 3.—VIEW OF THE RUDD GROUND ALARM AS ARRANGED IN CHICAGO ELECTRIC LIGHT STATION.

The cost of running street railways with horse power and with electricity has been carefully estimated, and for the purpose of comparison a line running 50 cars is taken. Such a line, operated with horses, cost $300.75 per day, and with electricity, $69.50. The difference in favor of electricity is $231.25, or $4.62 per day saved on each car.

Cable Service in England.

The American who goes into a telegraph office in England for the first time to send a cable message usually undergoes an experience that confirms him in his opinion as to the superiority of the institutions of his native land. He has just arrived and is anxious to inform the folks at home, so he stops on his way to the railway station or hotel. Telling the "cabby" to wait, he grasps a blank, fills in the necessary words, lays down his shillings and prepares to go. "Wrong form!" says the clerk, politely but firmly. The traveller looks around helplessly until some one, seeing his embarrassment, hands him the white sheet required for cable messages. He gives it to the clerk with a sigh of relief. "Must be stamped!" replies that official, pointing to a sign of "Stamps sold here." The traveller hands his message to the bright-faced girl who presides behind the iron-railed counter. "You must get it rated, sir!" she says. Half in despair, anxious, maybe, to catch a train or join some waiting friends, he finds the rating clerk, buys the stamps from the interesting young lady, and at last, ten minutes or more having passed, has his message accepted and started via a pneumatic tube to some more central station, at which the operating room is located. Many are the excellencies of the English postal telegraph service, but promptitude is not always one of them. It is just to say the new cable company has dispensed with many of the formalities which are so trying to anyone accustomed to American ways.

Electric Lighting in South Carolina.

The city of Charleston for the past two weeks has been on a considerable stir over a fight between the gas and electric light companies.

The committee on lighting met and four of the five members were in favor of the electric light, but the chairman, the largest stockholder in the gas company, sent in a minority report.

The council at their first meeting stood 12 to 12. A special meeting was ordered for another night. A new proposition was sent in by the electric light company which was accepted by vote of 13 to 12. The electric light company will therefore furnish 100 arc lights of 1,200 candle-power, Thomson-Houston system.

The chairman of the lighting committee sent in a pitiful report, begging for the contract, as the stockholders of the gas company were mainly "widows and orphans of Charleston," while those of the electric light company mostly millionaires of Boston!

The whole State is now in favor of the electric light; all the leading papers which have had anything to say are in favor of the electric light.

Gas Engines for Electric Lighting.

The practicability of using gas engines for electric lighting has been recently demonstrated at a restaurant in Los Angeles, Cal. The installation was by the Rhodes & Keese Electric Company.

A 15-horse-power Otto gas engine furnishes power for the operation of over 100 16-candle power incandescent lamps (Thomson-Houston system), which, it is claimed, is done with less cost than that attached to the burning of 75 gas jets direct from the street supply.

It seems probable that these developments must hasten the solution of the problem of domestic lighting. The tallow dip developed into the brighter gas, which in turn must slowly, perhaps, but surely step aside, and make room for the cleaner, cooler and more brilliant electric light for the illumination of homes.

Electrical News from Kansas City.

The Vine Street Electric Railway made a very successful trip on the 23d, and was opened for business on the 24th They are running two cars now, and have one in reserve. They have three more cars ordered. Each car is equipped with two 10 horse-power Thomson-Houston motors, and lighted with five incandescent lights. The station is very conveniently arranged with one 80 horse-power generator driven by a 100 horse power Armington & Sims engine. The Western Electric Construction Company, of this city, constructed the work, and the Pond Engineering Company put in the engine and boilers.

Business is very lively with the Edison Company at present, and they have a large force of wire men busy all the time.

The Royal Electric Company, of Peoria, Ill., sold through their agent, Mr. Jenkins, an incandescent plant for the Hudson Kimberly Publishing Company.

The Gate City Electric Company report business very good, having sold over 100,000 feet of Okonite the past week.

The Pond Engineering Company recently sold one 75 and one 150 horse-power Armington & Sims engine, and one 400 horse-power Hoppes heater to the North East Electric Railway Company.

Mr. Paul W. Bossart, for a long time past the general manager of the Inter-State Electric Company, has resigned his position, and in the future will represent the National Electric Traction Company, of Detroit. Mr. Thos. F. Clohesey will assume the duties of manager for the company in Mr. Bossart's place.

The following figures relating to Kansas City are furnished by Mr. E. R. Weeks:

"Kansas City has a greater mileage of cable street railroads than any other city in the world; is the twelfth city of the United States in banking capital; tenth in bank clearings; ninth in volume of post office business; fifth in volume of telegraph business; third in transfers of real estate; second in live stock and packing house business; second in the number of steam railroads; second in volume of passenger traffic; first in per cent. of profit from post office; first in the number of telephones in proportion to the population; first in the number of telephone calls per telephone; first in the volume of agricultural implement business; first in extent and resources of tributary territory. In the tributary regions are over 600 cities, whose populations range from 3,000 upward. Less than 50 per cent. of these cities are supplied with central station electric light service. Though most of them have street railroads, there are only 45 electric roads in operation."

Kansas City, Nov. 7, 1889. W.

Uranium Discovered in Quantities.

In a mine at Cornwall, in England, there has been discovered a lode of the rare and precious metal uranium, which has hitherto only been found in small pockets or patches and in two or three widely separated localities. So rare is it that a century ago its existence was unknown, and so valuable is it that the market price is about $12,000 a ton. With platinum and copper the metal forms two fine alloys, each resembling gold, and offers a substitute for gold in electro-plated ware. On account of its high electrical resistance it is also likely to be largely used in electric installation. Its rarity and high price have hitherto interfered with its use in these latter ways, but the discovery in Cornwall may perhaps lead to its general introduction for such purposes.

The Great Northwestern Telegraph Company's system is being extended considerably and the old lines rebuilt this season. A new highway line from Brandon to Carberry, Manitoba, has just been completed and opened for business, and a large force of men is engaged building a line along the Morris-Brandon branch of the N. P. & M. to Brandon; that line will be ready for business about December 10th, and will have an office at every station of the railway company. The line between Minnedosa and Brandon has been rebuilt, and men are now at work rebuilding the line from Winnipeg to Pembina. A new line has been built to Portage la Prairie along the N. P. & M., and the old line via Stonewall has been torn down. A second wire will be shortly strung to the Portage. The company's connection with the M. & N. W. Railway Company's line is still maintained. No further extension than those above referred to will be made this fall, as the season is too far advanced to undertake any additional work. The new lines open up a big territory for the Great Northwestern.

The Manhattan Electric Light Company —Description of its Interesting Steam Plant.

The Manhattan Electric Light Company, which is one of the new local electric lighting companies in the city of New York, has every reason to be proud of its new station located near the East River on 80th street. The building is three stories and basement, and throughout its interior arrangement is an excellent model for a large electric light station. A brief description will interest all our readers.

On the second floor are located the station offices of the company, the arc light testing room, store room and carpenter shop, reached in addition to the stairway, by means of a large freight elevator. The cupola for the wires is near the center of the building, each wire being protected by the most modern lightning arrester and fuse.

The first, or street floor, is the machine room, where a very business-like scene is portrayed, the room being nearly filled with the immense Slattery alternating current dynamos for incandescent lighting, and with the Fort Wayne dynamos for arc lighting. A portion of the center wall is covered with voltmeters, ammeters, and a very complete switchboard, which is an interchangeable board, it being possible to connect any line with any machine in the station. The company is now supplying some 300 arc lights, the dynamos for this work being grouped on the north side of the room. About 18,000 incandescent lights are now being supplied with current, and the station has been constructed so as to have a capacity when full of nearly double that number of lights. South of the machine room on the same floor is the repair shop and testing room. An extension off this room running south is used as the laboratory.

At the time of the visit of the representative of the REVIEW a number of the new Slattery meters had just been received, and machine room superintendent, Mr. Geo. Stevenson, stated that they were giving universal satisfaction. Our readers will remember that this improved meter was recently illustrated and described in the ELECTRICAL REVIEW.

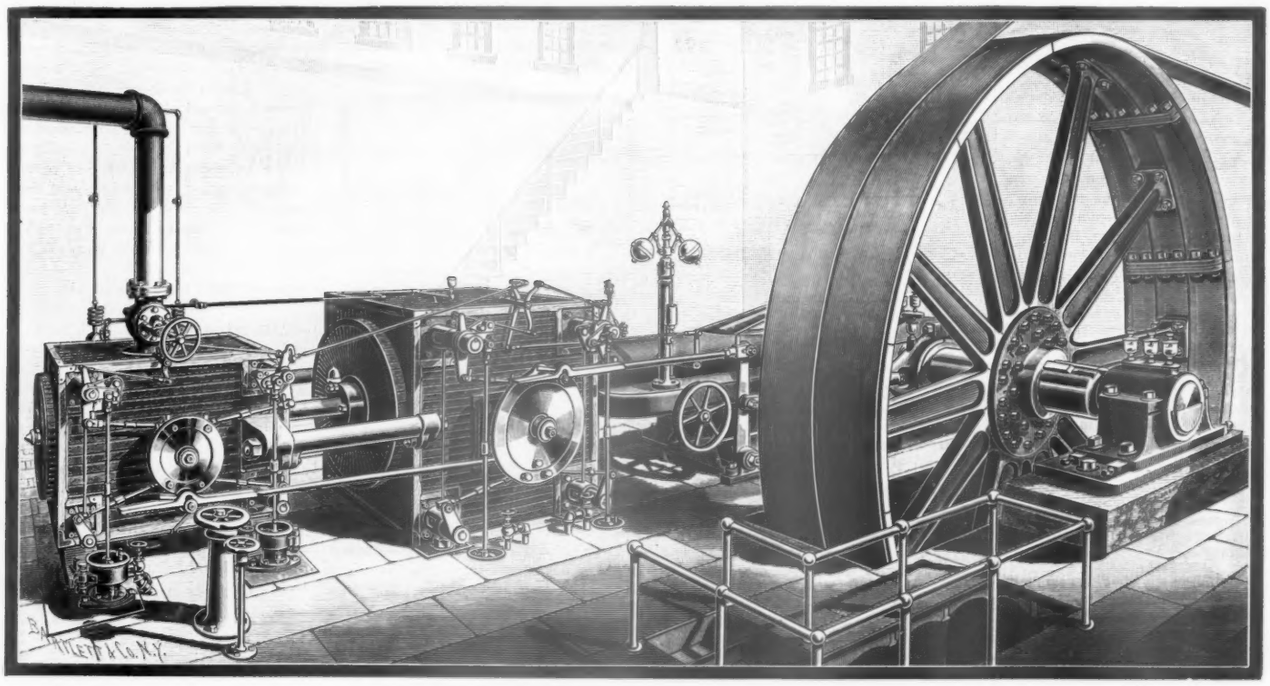


FIG. 1.—VIEW OF PORTION OF STEAM PLANT, MANHATTAN ELECTRIC LIGHT COMPANY, NEW YORK.

THE STEAM PLANT.

The engines used by this company were made by the well-known Hamilton-Corliss Engine Works, owned by the Hooven, Owens & Rentschler Co., Hamilton, Ohio, and embody all the latest improvements in steam engines, and were selected by

a competent and well-known expert engineer. The steam plant consists of four tandem compound condensing Hamilton-Corliss engines of 600 horse power each, and two single cylinder condensing engines of 300 horse power each, or 3,000 horse power in all. A brief description of these tandem-compounds is not amiss here and will be of interest. The high-pressure cylinders are 22 inches in diameter and 48 inches stroke, while the low-pressure cylinders are 42 inches in diameter and 48 inches stroke. The engine bed is of the "girder" type and is very heavy and strong. The pillow-block bearing has adjustable gibs or quarter boxes and adjustable bottom bearing, which can be removed or duplicated with little trouble and no detention—a patent said to be owned exclusively by this engine company. The main shaft is of wrought iron 18 inches in diameter, 12 feet long, carrying a band wheel 24 feet in diameter, 50 inches face and weighing 35 tons. The speed of these engines is 74 revolutions per minute. The horse power developed by some of them has frequently exceeded 700. The valve gear, while of the usual Corliss type, is of fine proportions, accurate in its performance and of bright fine finish. Both high and low pressure cylinders are provided with this valve gear, thus giving to each cylinder an automatic cut-off with an automatic regulation.

A jet condenser is furnished with each of these engines, with air-pump (driven from the crank-pin of engine), brass-lined, with brass trunk and buckets, and of large proportions. Their performance has been eminently satisfactory, although the condensing water is salt and taken from the East River. Another good feature of the plan of construction is the location of all pipes and connections, and the steam receiver under the floor of the engine room.

The builders of this engine guarantee duplication of parts in every case to an exactness, and being exclusive Corliss engine builders, they devote their entire time, skill and means to the development of their engines in every detail. Their engines are well and favorably known in almost every State and territory in America, east as well as west, and for electric lighting purposes are particularly effective and popular.

Besides the tandem-compound, this company make their engines also as twin or right angle compounds, or twin-tandem, vertical as well as horizontal, and where the conditions are not suitable for compounding or single cylinder condensing, they furnish any size or style of single cylinder high pressure engines of fine quality and finish. The works of this company are among the largest in the United States, located in the beautiful Miami Valley at Hamilton, O.

THE OFFICERS.

The Manhattan Electric Light Company, as most of our readers are aware, uses almost exclusively the arc and incandescent systems manufactured by the Fort Wayne Electric Company, Fort Wayne, Ind., and since its organization in this city has met with pronounced success.

The active officers of the company are A. C. Bernheim, president; Robb MacKie, general manager, succeeding Mr. E. A. Leslie, who has taken entire charge of the subway work of the company, a department that has rapidly grown in importance; George Hoag, superintendent; George Stevenson, superintendent machine room, and Duane Tinklepaugh, chief engineer.

Urbana, O.—The Urbana Electric Light and Power Company is incorporated; capital stock, $30,000.

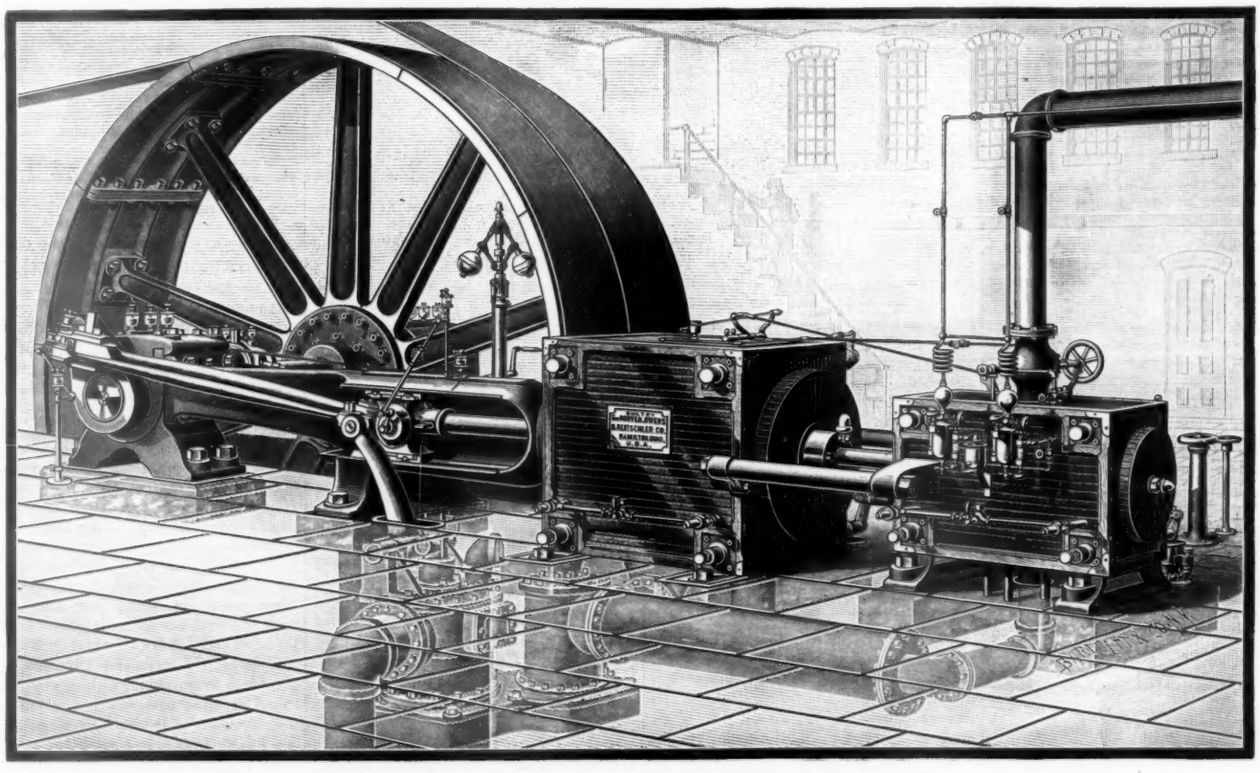


FIG. 2.—ANOTHER VIEW SHOWING PIPING BENEATH.

Bryan, Texas.—The Bryan Water, Ice and Electric Light Company has been organized by J. W. Henderson, W. Smith and others, with a capital of $50,000. They will build water and electric light works and an ice factory.

Chatham, N. Y.—The Chatham Electric Light Company was incorporated last week with $15,000 capital. The object is to manufacture, generate, produce and furnish electricity for light and power. The trustees are James Morehouse, Chatham; Clarence R. Dean, Albert M. Card, New York.

Albany, Ore.—Articles of incorporation were filed with the county clerk of the Albany Canal, Water and Lighting Company. The incorporators are C. C. Hogue, A. Bensell, J. O. Wilson and J. L. Ripley. The capital stock is $300,000, divided into 3,000 shares of $100 each. The place of business is in Albany. The object is to operate the Santiam canal, Albany water works, electric light, power and factories. The stockholders are composed principally of a syndicate of New York capitalists, including Col. T. E. Hogg, president, of the Oregon Pacific Railroad; Geo. S. Coe and others.

Attica, N. Y.—The Attica Electric Light Company has been organized with a capital of $30,000. Applications for the light are coming in rapidly and the managers expect to have the plant in working order by the first of December.

Keyser, W. Va.—A certificate of incorporation has been issued to the Keyser Electric Light and Power Company, organized for the purpose of supplying light, heat and power, by means of steam and electricity to the public of the town of Keyser.

Springfield, Ill.—The Secretary of State issued a license to the Instantaneous Fire Alarm Company, at Chicago, to manufacture and sell mechanical devices for fire and police alarm; capital stock, $500,000; incorporators, Milton Weston, U. W. Weston and R. P. Mason.

Bangor, Me.—The Public Works Company, Bangor, Me.; capital stock, $250,000; paid in, $300; par value of shares, $100. President, Frederick M. Laughton, Bangor; treasurer, Francis H. Clergue, Bangor. For constructing and maintaining water works, gas works, electric light plants and electric railways. Certificate filed, Nov. 1, 1889.

Salisbury, Md.—The Salisbury Electric Light Company has been incorporated by Preston Lee, of Wilmington, Del., A. A. Gilies and E. S. Toadvine; capital stock, $30,000.

Chicago, Ill.—Chicago Electric Railway Company; to operate railways in Illinois; capital stock, $1,000,000; incorporators, O. M. Brady, L. P. Hicks, Charles F. Swigart and others.

Peoria, Ill.—The Non-Magnetic Watch Company, at Peoria; for the manufacture of watch movements; capital stock, $5,000; incorporators, W. H. Hammond, H. H. Hopkins, Carrie Geathard.

Troy, N. Y.—A stock company has been incorporated under the name of the Troy Dynamo Company, with a capital of $20,000, divided into 1,000 shares of $20 each. The stockholders are William L. Hall, Justus Miller, Charles E. Hartwell, and H. S. Pruyn of Hoosick Falls. The company is now making a few of these machines at Knowlson & Kelley's machine shop. If successful it will build a large plant. Justus Miller has been elected president of the company and William L. Hall secretary.

Baltimore, Md.—The Electrical Construction Company has been incorporated. Capital stock, $12,000.

Griffin, Ga.—H. C. Burr, J. G. Ray and others have organized a company with a capital stock of $25,000, for the purpose of lighting the town.

Albany, N. Y.—Articles of incorporation of the Empire Gas and Electric Light Company of Suffolk County were filed last week with the Secretary of State. The company is to supply gas and electricity to public and private buildings, streets, etc., in the town of Huntington. The capital is $200,000, divided into 20,000 shares, and the trustees are George Olney, Henry L. Vansyckle and Charles A. Godley.

Indianapolis, Ind.—The Indiana Land and Improvement Company; for buying land and laying out town sites, building mills and erecting electric light plants. The capital stock is placed at $50,000.

Warren, Ohio.—The Warren Electric Light and Power Company has been recently incorporated under the State laws, and has for its officers the following men: President, O. L. Wolcott; treasurer, E. H. Wells, Pittsburgh; secretary, Chas. Fillius, and directors, E. H. Wells, T. W. Case, O. L. Wolcott, J. N. Green and H. B. Weir.

Bangor, Me.—The Penobscot Water and Power Company, Bangor, Me.; capital stock, $200,000; paid in, $300; par value of shares, $100. President, Francis H. Clergue, Bangor; treasurer, Frederick M. Laughton, Bangor. For construction and maintaining of water works and dams. Certificate filed Nov. 1, 1889. Also the Penobscot Electric Company, Laughton and Clergue, Bangor, Me.; capital stock, $100,000; paid in, $300; par value of shares, $100. President, Francis H. Clergue, Bangor; treasurer, Frederick M. Laughton, Bangor. For generating and selling electricity for lighting and power. Certificate filed Nov. 1, 1889.

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We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

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Edison has subscribed $5,000 to the World's Fair project. Electrical men of means, here is a good example.

Our electric light friends will be interested in our London letter this week. The method of charging for the electric light in that city, as shown by the propositions submitted by the various companies, is somewhat different from the custom on this side, yet there is much to commend in the English method, which evidently aims to reach a basis where the exact amount of electricity generated will be recorded and paid for.

The Post Office Department has a rapid stamp-cancelling machine in use in the Boston post office which it is proposed to run by steam power. The machines are likely to come into use in all large post offices and are just the things to which small electric motors can be profitably adapted.

The second of the regular meetings of the Electric Club, this season, occurs Thursday evening, November 21st. It will be the occasion of another extremely pleasant social evening, and an interesting and able address may be expected. Though the attendance is always good, we do not think that the electrical men fully realize the value and importance of these gatherings. The Club House should be crowded whenever they are held, and we predict everyone present will be benefited.

The local electric light companies, the ones which have had to bear the brunt of the recent fight in electric lighting, have greatly improved the aerial systems here in the past few weeks. Manufacturers of the highest grade of insulated wires have been rushed with orders from this city as never before. We trust the companies will not stop the work of improvement. There is much yet to be done, and while the expense must be enormous at first, we predict that it will pay in the end.

An educated fish trained to carry a torpedo in its mouth and fasten it on the hull of any desired vessel, could not do the job any more effectively than the Sims torpedo, elsewhere fully described in this issue. It is a triumph of electrical engineering, and vindicates the assertion that when a desired effect cannot be properly accomplished by the application of the other forces of nature, means can generally be found by which electrical energy will do it, and mostly too in a way far simpler and more controllable. One great advantage possessed by electricity as a power transmitter lies in the fact that with it the troubles of latent heat are forever abolished. Transmission by compressed air, gases or steam is notoriously subject to great loss of efficiency, and preliminary calculations for given work are most difficult. The beautiful simplicity of the problem, however, in electrical transmission brings out its advantages more surely. In that respect, the Sims torpedo has an insuperable advantage. The solution of torpedo difficulties effected by Mr. W. Scott Sims adds another leaf to the circlet of honor on the brow of our Amber Goddess.

Strange it is, indeed, that in the three great cities, London, Paris and New York, the existence of the electric light has been dwarfed and distorted by unintelligent and corrupt municipal control. There is no need to enter into a discussion of the wretched jobbery which has obtained in New York, for it is fresh in the mind of every electrical reader. In London, where for years it has been kept in leading strings, it did seem as though, at last, the young industry had broken free and would assert itself against its natural rivals. We now learn that its apparent freedom was only for the moment, and that the lighting of the city must again brook "the law's delay." Was not the beautiful Avenue of the Opera, in Paris, ablaze with the electric light in 1881, and yet to-day the industry in that city has been practically legislated to death? It would seem, to state it mildly, that in very large cities where municipal control can be more easily influenced by older and well established industries, the electric light has not fared so well as in smaller cities where less "pull" can be brought to bear on the powers that be.

A movement is on foot to erect, to the memory of the late Dr. Joule, a monument in Westminster Abbey. Perhaps no other man in our day has so profoundly influenced the appliances of civilized life without being generally known as the cause of such influence. Although every student of physics remembers the name of Joule with respectful admiration, yet the great mass of mankind only remember him as one of the names they learned in school and that he was someway connected with the discoveries of the laws of energy. And yet he is to have a monument in Westminster Abbey where rest many of the great rulers of nations, rulers of human thought, and the great artists and the great poets of the world. The conservation of energy and the correlation of forces to the study and practical demonstration of which he devoted much of his life, are factors in our present methods which are but little realized by the great mass of people who enjoy them. On his monument should be engraved: Here lies one to whom mankind is inestimably indebted, for he demonstrated that all forms of energy are in their nature alike, can be converted one into the other without loss, but cannot be destroyed.

A JUDICIAL DECISION OF IMPORTANCE TO ARC LIGHT MEN.

The United States Supreme Court has finally settled the "Annular Clamp D" question, by affirming the decision of Judge Shipman, of the United States Circuit Court for the Southern District of New York, that Charles H. Hayes, of Ansonia, Conn., did invent the clamp in June, 1876, and that the claims relating to it in Charles F. Brush's reissued patent No. 8,718, granted May 20, 1879, are invalid. This was the case of the Brush Electric Company *vs.* Condit Hanson & Van Winkle, which was appealed by Brush. Elaborate mechanical exhibits were produced before the court, exhaustive arguments made by the attorneys, and the evidence was carefully examined. The attorney for the Brush Company stoutly contended that, as the Hayes clamp was square, it did not anticipate the Brush clamp which was round, but the Supreme Court decided that "the improvement, if any, in the use of the circular clamp over the rectangular clamp was only a question of degree in the use of substantially the same means." The decision, which was delivered by Justice Blatchford, on the 4th inst., quotes Judge Shipman's decision (reported in 22 Blatchford, 246), in full, and says: "His views on the subject are correct and well and accurately expressed, and we could not add to their force by a prolonged discussion of what is purely a question of fact."

THE INTERSTATE COMMERCE LAW AND THE TAXING OF TELEGRAPH AND TELEPHONE COMPANIES.

Judge Butler, of the U. S. Circuit Court, Philadelphia, has filed an opinion in which he reverses the verdict of the jury in the suit of the city of Philadelphia against the Western Union Telegraph Company. The verdict was for some $14,500, covering interest and license fees for the years 1885, '86, '87 and '88, at the rate of $1.00 per pole per year, and $2.50 per mile of wire.

Judge Butler decides that this is excessive, and that it interferes with the Interstate Commerce law. He decides that it is a tax and not a police regulation. He states:

"The plaintiff cannot tax the defendant, not only because it is not authorized to do so, but because the State is without power to confer such authority. The imposition of a tax would be an interference with interstate commerce, and, therefore, an infraction of the federal constitution. The plaintiff may, and is in duty bound to, subject the defendant and other similar companies to such proper conditions, restrictions and supervision respecting lines within its limits as are necessary to the public safety, and consequently to such charges as will enable it to perform this duty without loss to itself.

"The ordinance imposes payment of $16,000 annually. This is five times the amount required. It seems to follow as a necessary consequence that the ordinance is unreasonable. It compels a payment annually of about $13,000 in excess of the amount necessary. This is a tax pure and simple. The city can not collect and lay by a sum to insure itself against imaginary future demands which may possibly arise.

"Judgment must therefore be entered for the defendant in spite of the verdict."

This decision will also, we think, apply to telephone companies operating in more than one State. For instance, the system of the Metropolitan Telephone Company of New York extends into the States of New York, New Jersey, and Connecticut, and the New York and New Jersey Telephone Company, of Brooklyn, as its name indicates, has exchanges in both States. The telephone companies when subjected to excessive municipal taxation, as is often the case through a mistaken notion of telephone profits, will find this decision of value.

"THE MICROBE OF THE MAGNET."

Under the above heading the REVIEW published over a year ago an editorial which treated of the mysterious power of the magnet. This article apparently attracted great interest, and of all the many widely-quoted things taken from the columns of this journal, we think that this one has received the most attention, appearing in nearly all the leading journals of this country, and also in many published in distant lands and in foreign languages. We reproduce a portion of the article, and still await an explanation of the mystery:

"A horseshoe of steel can be magnetized in ten seconds by the current of a few amperes from a battery, a ridiculously small amount of energy all told, and such a magnet can lift many pounds of iron in contact. But without contact it may lift and hold a pound of iron easily.

"It will hold that pound for an eternity, and every second of that time without end the magnet is expending energy, until it foots up an almost inconceivable total of actual power.

"Not alone that, but the magnet of one pound lifting power to-day may, and will be, stronger to-morrow.

"Where does all this really tremendous amount of energy come from?

"By what inscrutable process does the mere magnetization of a bar of steel make of it a machine for the transformation of energy? Not a reactionary or storage device, which, like a steel spring, honestly gives back approximately all it has received, but a perpetual transforming or converting machine.

"There is a hidden process going on of some kind; energy is going into the magnet all the time it is doing work, energy in some form.

"Where does it come from; gravity? atmosphere? solar rays? earth currents? Who can say? It is a great problem, worthy of a lifetime of indefatigable research.

"It is a microbe, and it will be discovered; and the discovery will make electricity the queen of nature's forces, and steam will become a dim vision of the dark ages of the past."

ELECTRICAL INFORMATION IN THE NOTE BOOK OF OUR TRAVELING DEFENDERS.

An unusual amount of information relating to all sorts of electrical matters is being gathered in foreign countries by the Military and Naval *attaches* of some of the principal United States legations. These officials are generally regarded as rather ornamental, harmless diplomats, with not much of anything to do, but they usually go about with their eyes wide open and their note books handy. Some of the information received from them is made public, but most of it is considered confidential, either because of its importance to the government or because it is not desirable to raise any inquiries as to the source from which it was obtained. Some years ago, before Gen. Abbot made such a revolution in submarine warfare, a book of 300 pages, entitled "Notes on Torpedoes, Offensive and Defensive," was printed in Washington, without anything to show by what authority it was published and, at that time, it was regarded as quite a remarkable book. It turned out that this was a reprint of a confidential document of the English government, compiled by Major Stotherd, of the Royal Engineers. An enterprising officer of the U. S. Navy, enjoying a trip to England, having been given an opportunity to look over Stotherd's "notes," spent a day and a night in making a copy of the entire work for his bureau. Its publication led to some spicy correspondence between the two governments, but no serious results ensued. The Bureaus of Information manage such affairs better now.

The officers now on duty at U. S. legations abroad are Lieut. James C. Post, of the Army Engineers, and Lieut. B. H. Buckingham, U. S. N., at London; Lieut. H. D. Borup, Army Ordnance Corps, and Lieut. Aaron Ward, U. S. N., at Paris; Lieut. James C. Sanford, Army Engineers, at Berlin; Capt. Otto L. Hein, U. S. Cavalry, at Vienna; Lieut. Nathan Sargent, U. S. N., at Rome, and Capt. F. B. Hamilton, Artillery, at Madrid. Lieut. Ward's jurisdiction extends to St. Petersburg and Berlin. Most of these officers have had experience with electrical affairs. A story is going around that a prominent statesman, who was offered a foreign mission, declined to go unless his wife would accompany him; his wife would not go without her daughter and the daughter would not go unless she could take her husband, who belonged to the army, and so it came about that our legation, of the first class, near the court of His Royal Highness, has a military *attache*.

ELECTRICAL NEWS.

What is Transpiring in Electrical Circles in the Leading Cities.

OUR BOSTON LETTER.

An Interesting Law Suit.—A suit in equity was begun in the Supreme Court, Friday of last week, against the officers of the Thomson-Houston Company by some stockholders, to settle the question of ownership of the patents in the electric welding process. The plaintiffs claim that these patents are the property of the Thomson-Houston Company, but the directors take a different view, and a separate corporation has been formed to carry on the electric welding business. Much interest naturally attaches to the case.

Boston Museum.—A novel effect is produced in "Hands Across the Sea," now running in its third month at this theatre. One of the scenes of the play is laid on board a ship. When the curtain rises the wind is heard whistling through the rigging and the flag at the mast head is seen flying in the breeze. The effect is very startling and, with the well-executed scenery, produces a strong sense of realism. All this is accomplished by small "C. & C." fan outfits which are placed behind the mast where they are out of sight.

Lighting Men.—The Massachusetts Electric Lighting Association was formed in Boston recently by 45 gentlemen, representing 40 electric lighting companies, using all forms of apparatus, and having a combined capital of $4,000,000 or $5,000,000. Mr. F. A Gilbert, the president of the Boston Electric Light Company, was elected president of the Association, and an executive committee, consisting of the president, *ex-officio*, Hon. T. C. Bates of Worcester, George W. Fifield of Lowell, C. L. Edgar of Boston, and C. A. Nichols of Springfield, was chosen to have charge of the affairs of the organization. The object of the association is to foster and promote the common interests of its members, and the membership is limited to companies engaged in the business of local electric lighting and the sale of electric power for commercial purposes. The business meeting, held at the Tremont House, occupied the time from 12 to 3 o'clock, when the assembled gentlemen sat down to an elegant dinner, at which they were the guests of the Boston Electric Light Company.

Train Lighting.—The Johnson Storage Battery Company of this city have been putting in a plant for lighting trains on the Intercolonial Railway in New Brunswick. Mr. A. R. Tinkham has spent the last five weeks in equipping an experimental train which is now lighted successfully between Halifax and Montreal.

Simplex Wire.—Mr. Pond, of the Simplex Electric Company, states that his firm is running their three factories to the fullest capacity both night and day, and that it keeps them all busy to satisfy their customers. During the last four months they have received orders from St. Louis alone which reach a total of over 1,000 miles of Simplex wire.

Boston Electric Club.—The dinner of the club to which the members were invited for November 7th, was postponed until Tuesday evening, the 12th. A discussion concerning "Municipal Regulation and Control of Electric Wires and Wiring" will take place after the dinner, which will be held at the Boston Tavern. T. W. S.

Boston, Nov. 11th, 1889.

OUR WASHINGTON LETTER.

A Queer Fight.—The attorneys for the District are taking steps to dissolve the injunction recently issued prohibiting the local Westinghouse Company from constructing underground lines, with a view of bringing the matter before the higher court and getting a decision as to the authority of the commissioners in granting permits for such work. In this contest the commissioners and the Westinghouse interests are on one side and, oddly enough, the United States Lighting Company and the gas company are working harmoniously on the other side.

Personal.—Capt. T. W. Symons has completed his duties at the district commissioners office and will leave for Portland, Oregon, on the 9th inst. Willis B. Hawkins, the serious man who keeps the *Daily Post* supplied with fun, is an old "C., B. & Q. R. R." operator, and he has started a scheme for gathering all the ex-operators in the city in a social meeting. There is a large number of them in government service, some holding important positions, and an interesting reunion is anticipated.

A New and Novel Electric Railway.—Malone Wheless is the name of the inventor of an electric railway system which is being tested in Washington, D. C. The peculiar features of this system are a track made of rails shorter than the car used on them, each rail being electrically separated from the others; a main conductor buried in the ground with branch wires leading to every rail in the track; a series of electro-magnets placed underground beside the track (one magnet to each pair of rails), actuated in turn by a battery carried on the car and arranged to open the main circuit and divert the current through the car wheels and the motor while the car is on the pair of rails with which any one magnet is connected. The advantages claimed are that both overhead lines and underground conduits are dispensed with, and that the cost of construction is less than that of a road using either of them. The project is backed by a heavy capitalist, Mr. Samuel E. Wheatly, who proposes to have the system put in practical working condition before attempting to equip any roads for regular business. A quarter-mile experimental track, with sharp curves and heavy grades, has been constructed near the power-station of the Eckington road from which current will be supplied, and it is expected that a car will be running and on exhibition by December 1st. G. C. M.

Washington, D. C., Nov. 9, 1889.

OUR CHICAGO LETTER.

Installations.—The Excelsior Company will install a plant for Murphy, Wasey & Co., Omaha, Neb., 150 incandescent lights, and one for the *Evening Journal* of Chicago, of 225 lights. Mr. J. H. Reid, manager of the Mather Electric Light Company, reports the following sales the past week: Chamber of Commerce, Chicago, 3,600 lights; Marquan Opera House, Portland, Oregon, 800 lights; Julius Andrea, Milwaukee, 50 lights; Kent & Stuckfield, 50 lights. Spencer H. Gale, the Chicago representative of Cassidy & Son, has secured the contracts for furnishing the gas and electric light fixtures for the following buildings: Marquan Opera House, Portland, Tacoma Opera House, Tacoma, Wash. Ter.; California Hotel and Theater, San Francisco, Cal.; Spaulding Hotel, Duluth; *Pioneer Press*, St. Paul; Aberdeen Flats, St. Paul; "New Hotel," Helena, Montana.

The Detroit Electrical Works have just gotten out a very neat descriptive chart of their annunciators, burglar alarms, etc. At Cleveland, Ohio, the Detroit Electrical Works have recently installed a 420-number annunciator with return calls. Among the numerous devices that these works have introduced in connection with their system of electric street car propulsion, none will perhaps be more appreciated by the men in charge of cars than the "warning bell" or car gong lately put on the market by this company.

It is a mechanical gong designed by their electrical engineer, Mr. F. B. Rae, and is arranged to be operated by the foot of the driver. The gong is placed underneath the car platform, one at each end of the car, and provided with a detachable foot push, which, being removed from the gong not in use, prevents its operation by passengers; by this device the driver has at all times both hands available for the control of the switch lever and brake.

The above company have lately installed in their factory an incandescent plant of 225 light capacity.

Electrical Supplies.—The new representative lately sent out by the Electrical Supply Company in the shape of a catalogue, bright and new, seems to have increased the company's business to a great extent, as they are very busy and have all that their present force can attend to in filling orders, and report that they are unable to manufacture goods fast enough to supply the demand.

The Central Electric Company's sales of Okonite wire in the past week have been tremendous, the demand for this class of wire seems to be constantly on the increase.

Knapp Electrical Works.— The western agency of the Perkins lamp will, after Nov. 15th, be in the hands of the Knapp Electrical Works. Mr. W. G. Halm, vice-president of the company, will return to the eastern office.

The Club.—The Chicago Electric Club met in its parlors Monday evening of last week, with President S. A. Barton in the chair. Many long faces were noticeable among the gentlemen present for the reason that this was the last evening that President Barton would preside, and was also the occasion of his farewell supper. After the transaction of routine business, the resignation of Mr. Barton was read and accepted with many regrets. Many letters of regrets from invited guests were read, in which they regretted their absence and the departure of Mr. Barton. A motion was made by Mr. F. W. Parker to accept Mr. Barton's resignation and adopted by the club, after which Alex. Kempt presented the resolutions of the club. In closing a very neat speech he asked Mr. Barton to accept a copy, in which the members attest their love, esteem and friendship. After Mr. Kempt's remarks, Mr. Wilmerding presented Mr. Barton with a silver plate 12x14 inches on which were engraved the resolutions adopted by the club. Mr. Barton replied in a very neat and touching speech in which he thanked them all.

The Franklyn Electric Company, 120 Randolph street, are hard at work on a new dry battery. Many strong points are predicted for the little "Giant" which will soon be ready for the market. When seen by the REVIEW representative it had been short circuited five days and was still in operation.

Chicago, Nov. 9, '89. D. B. D.

U. S. Engineer School at Willett's Point.

Though the U. S. Government is abominably and shamefully slow and behind the age in adopting modern means of offense and defense, there has been no lack of diligence in affording means of practical education and training to the officers of the army and navy. Besides the excellent systems of teaching the rudiments at West Point and Annapolis, there are the practical training institutions at Willett's Point and Newport. The engineer school at Willett's Point, New York harbor, is under the very efficient charge of Lieut. Col. W. R. King, U. S. Engineers, who is also commander of the post. Primarily, the school is for the instruction of both officers and men belonging to the battalion of engineers in the various branches pertaining to their duties as engineer troops, but in the course for officers a most thorough training in the important branches of electrical science. Lieut. Col. King is an experienced electrical and mechanical engineer, and is ably assisted by Capt. of Engineers S. W. Roessler, who also is a skilled electrical engineer. Both are men of exceptional intellectual attainments and have done a great deal of original work, which owing to government "red tape" seldom becomes public. Lieut. Col. King years ago displayed his ingenuity by designing what was probably the first practicable disappearing gun-carriage. The now famous mammoth electro-magnet, whose cores comprised two 15-inch Rodman guns, took birth in his fertile brain. Many interesting facts were brought out in experimenting with the magnets.

The school is provided with an excellent laboratory containing all the modern instruments and apparatus requisite in a complete course of electrical engineering. Dynamos, engine, motors, etc., and a large machine shop is now nearly completed. All construction work of such character is done by the troops under the superintendence of the officers.

But much more than the mere provision of educational appliances should be conceded by Congress. It is strange that often the appropriation which is the most desirable is the very one to be spurned by our national legislators. The need seems perhaps so distant as to be beyond mental vision. But, as a matter of pride, we should think more liberal appropriations ought to be granted these splendid schools. They are under the charge of officers whose every aim is to advance those under instruction in the paths of modern science; the standing of a U. S. Engineer is very high all over the world. Give them more scope; let a war come to pass and it will be found that the U. S. Engineers will be at the front, not merely in valor, but, still better, in ingenuity and the practical knowledge to mold the emanations of genius into whirlwinds of destructiveness.

—— The building of an electric road from Canton to Massillon, Ohio, is announced.

—— A small point in the electricity-gas conflict has been developed by the government's use of the Lungren gas burner, which is commonly placed in the center of and beneath the branches of a fixture which support the electric lamps. Some of the incandescent electric companies have contended that the excessive heat radiated by these large gas burners would destroy the insulation of the fixture wires, and therefore "gas must go," but some of the government offices find the Lungren burners very useful.

—— The Edison Electric Light Company has filed a bill of complaint in the United States Circuit Court against the Edison Electric Illuminating Company, of Cumberland, Md., to restrain the latter company from disposing of any of its capital stock pending suit, and to compel it to assign to the complainant full-paid and non-assessable shares of capital stock of the par value of $5,340 or the value thereof, and to answer whether or no, in violation of an alleged agreement, the defendant issued bonds to the amount of $17,800, and having a priority of lien upon the property of defendant. The court granted the preliminary injunction as prayed.

PERSONAL.

Mr. H. L. Lufkin, of the "C. & C." Motor Company, has returned from an extended visit to the Pacific Coast where he found the demand for electric motors ever on the increase.

Maj. Gen. John I. Sabin returned to his San Francisco home this week, having greatly enjoyed a flying visit East and the fine California weather we have been having here for the past two weeks.

Mr. George C. Maynard, the able correspondent of the REVIEW, has again assumed his duties as our Washington correspondent. During Mr. Maynard's absence, Mr. George E. Morse supplied us with excellent reports of the electrical happenings that center about the Capital.

Gen. H. S. Huidekoper, of the American Bell Telephone Company, with headquarters at Philadelphia, was a New York visitor last week. The telephone companies of Pennsylvania, he states, show a regular gain in subscribers and the outlook is very satisfactory.

Mr. J. H. Reid, manager of the Mather Electric Company with headquarters in Chicago, was an Eastern visitor last week with headquarters at the Electric Club. Mr. Reid is a successful electric light man and has closed a great many important contracts for his company in the West.

M. Marmaduke M. Slattery, the inventor of the electrical tricycle, came on from Fort Wayne and visited his New York friends last week. Electrical work in the West evidently agrees with Mr. Slattery, as he has recently gained so much in weight that his friends had difficulty in recognizing him.

Mr. C. Selden has been re-elected member of the city council of Baltimore for two years, and is the only Independent-Fusion-Citizen Democratic member of that body. The report that the genial electrician is receiving treatment at the Cotton Compress Company to reduce the size of his head so he can again wear his hat, we do not believe.

The Allegheny County Electric Light Company will hold a meeting at Pittsburgh, Pa., on January 4, to consider the matter of increasing the capital stock. The desire to increase the capital stock is prompted by the possibility that the number of incandescent and arc lights will need to be increased fully one-half. Another reason is that the company expects that it will be compelled at some future day to put its wires underground, and it desires to be ready for any emergency.

The edict has gone forth at telephone headquarters that the historic "hello," about which lurk so many tender memories, must go. Last week users of the telephone belloed central without provoking anything more satisfactory than "Number, please." Inquiry as to the cause of this phenomenon elicited the information that it was decreed that "helloes" be discontinued. The philosophy of the new order does not appear. Possibly the telephone manager has turned Universalist. Perhaps he thinks the hello bodes too much familarity and breeds contempt for the sweet-voiced central.—*St. Paul Pioneer Press.*

With regard to lighting in Madrid, the Electricity Supply Company of Spain was brought out last week under the patronage of Messrs. Murrietta & Company. The capital is £100,000 in 19,900 ordinary £5 shares and 100 founders' shares. The primary business of the company is the erection of a central station in Madrid, the contract for which has been given to Messrs. Hammond & Company at £80,000, to cover plant similar to that at that firm's West Brompton station, for 25,000 eight candle-power lamps, about 1,500 horse-power, the purchase of site and remuneration for obtaining concession.

The City of Columbiana, Ohio, is to be lighted by incandescent electric light for five years at $1,250 per year.

Telephonic News

*** The Missouri and Kansas Telephone Company is stringing a new metallic circuit between Kansas City and Topeka, a distance of 70 miles. The telephonic business between these two western cities is constantly growing.

*** The central telephone exchange in Concord, N. H., has received a new 100-wire switchboard, made necessary by the growth of the list of subscribers. It will be put in at once, and will be in operation in about 10 days.

*** A judgment of $285,916.50 in favor of John W. Mackay, and another for $31,952.34 in favor of Edward C. Platt, were obtained by default in the Superior Court of New York, against the Commercial Telegraph Company. The judgments were entered by Judge Dugro.

*** The telephone company of Cincinnati, Ohio, is suing the Sprague Motor Company in that city because of inductive interference with the service. The case will be heard December 1st, and will be watched with interest by the telephone and electric railway interests of the country.

*** A new telephone line has just been opened between Budapest and Prague. Austria, and the employés could not agree what language to use to each other. Some wanted to speak German, some Polish, yet others Magyar or Czech. At last the difficulty has been got over by an ordinance that French shall be used.

*** It is reported by a Philadelphia paper that a party of capitalists of that city have organized a company of $1,000,000 for the manufacture at Lebanon, Pa., of electric light, telegraph and telephone wires and insulated tapes under a new process. It is understood that an extensive plant will be erected at Colebrook, Pa.

*** The new underground service of the telephone company at Milwaukee, Wis., will be put in operation in about three weeks. As the system is being built entirely independent of the overhead line, the day it is completed the telephone company will have two complete systems. In order to accommodate the growth of the business a new switchboard is being constructed, the contract price of which is said to be $25,000.

*** The Erie Telegraph and Telephone Company, Lowell, Mass., announces that a quarterly dividend of one per cent. will be paid to stockholders, November 11th, 1889, that are of record at noon, Tuesday, Nov. 5th, 1889. Treasurer C. J. Glidden submits the following statement of the earning, expenses, construction and subscribers for the quarter ending Sept. 20th, 1889: Gross earnings, $178,526.45; gross expenses, $109,813.89; net earnings, $68,712.56; dividend No. 24, $4,000; construction (new), $10,098.11; net surplus for the quarter, $10,614.45. Subscribers connected July 1st, 1889, were 11,564; added during the quarter, 138; total number connected, 11,702.

*** The subscribers to the Cambridge, Mass., Telephone Exchange met last week to hear reports from the telephone management in regard to the poor service. General Manager Keller, General Superintendent Denver, Electrician Farnham and Superintendent Hanson were present to represent the company. It was stated by them that a thorough method of inspection had been established and the McClure system put in at an expense of $7,000 or more. These things ought to improve the service greatly; in fact, it was all that could be done except a metallic circuit, which would cost $175,000 and necessitate an increased rental. By an expression of opinion from the meeting, it was shown that since the agitation of the matter there has been a great change for the better in the service, especially during the daytime. It was voted to continue the organization and call public meetings when necessary.

ELECTRICAL NEWS FROM LONDON.

EXTRACTING GOLD BY MEANS OF ELECTRICITY — TRACTION INCREASED BY ELECTRICITY — ELECTRIC RAILWAYS IN EUROPE — ELECTRIC LIGHTING INCREASING IN POPULARITY IN LONDON.

The rich harvests which are being reaped by many of the South African mines have caused those interested therein to watch with the closest attention the results of the electrical process for gold extraction. Lately at Grantham, on the works of Messrs. R. Hornsby & Sons, a number of gentlemen inspected the Consen's process. The *Mining Journal* states the result as most satisfactory, the system being ingenious and of great applicability. The ore after being crushed passes through rollers which separate any iron substances and enters a large iron-banded barrel. Some chemicals are now placed with the pulp in the barrel which rotates, a current of electricity being at the same time passed through it and the ore. After about an hour the pulp is set free and flows into a large pan with rotatory fingers, then proceeding through riffles on the plates which are amalgamated, and afterwards over blanket strakes, rubbers supplemented by electricity keeping the plates clean. The rubbers are on endless chains connected to the positive pole, while the plates are connected to the negative of a battery or dynamo. The ore used in the trial was almost entirely pyrites and hardly any quartz, so that the test was a most severe one.

Some experiments of great interest have recently been carried out to test the effect of the application of electricity towards increasing the traction power of a locomotive. A small dynamo and engine were mounted upon the locomotive and supplied a current to the rear driving wheels, and it is claimed that increased friction was thereby caused between the wheels and the rails superior to that obtained by the use of sand and enabling a heavier train to be drawn. On the Trackville grade averaging 185 feet to the mile, with a train of 45 cars attached, the ascent was made in 28 minutes; without the use of electricity it is stated that 55 minutes would have been occupied. The current used is low tension, and it is claimed that the increased friction is completely controlled by the engine drawer. Should the invention prove of practical utility, there is no doubt it would be largely taken advantage of by railway companies, as the use of a pilot engine up heavy inclines would in a large number of cases be rendered unnecessary.

A German return lately made gives the number of electric railways in Europe as 11, the oldest being the Lichterfelde, Berlin, which was opened in 1881, is one and a half miles long, and with one motor and car carries yearly 100,000 passengers. The latest railway was that opened at Brussels last year, and has five motors and cars. The other lines, their age, length, and number of passengers carried are: Frankfort to Offenbach (1884), maximum number of passengers in one year, 990,000; at Brighton (1883), one mile, 1,000,000 in all; Portrush (1883), six miles, 100,000 per year; from Moedling to Hinterbruche (1884), 2.8 miles, 340,000 passengers; Blackpool (1884), two miles, 300,000; Bessbrook (1885), three miles, 300,000 passengers and 30,000 tons of goods annually; and finally, at Hamburg, opened last year, and for which no returns have yet been published. There are also two electric railways worked for mining purposes, viz: At Zankerode (1884), half a mile in length, with 17 motors and cars used, and at Hohenzollern (1884), where on a similar distance 16 motors and cars were used. The expenses of working on the two last, which daily convey 300 tons of minerals, are respectively ¾*d.* and 1*d.* per ton, whereas on the passenger lines they vary from 2*d.* to 4½*d.* per car mile.

At the Arts and Crafts Exhibition, now being held in the New Gallery, Regent street, W., some very handsome and artistic electric light pendants and electroliers are shown, the exhibits of the Globe Electrical Engineering Company, R. L. B. Rathbone and Messrs. J. Powell & Sons being particularly noticeable.

It is stated that a scheme is now under consideration to utilize the Deptford installation, whose mains are brought along the railway lines to Charing Cross, and to carry the same round the underground railway on the inner circle.

With regard to the electrical exhibition at Edinburgh, it is now expected to open early in May next, and towards the guarantee fund the Edinburgh town council have subscribed £1,000, and the town council of Glasgow £500, completing the sum originally stated to be required, viz: £20,000.

The Eiffel tower at the Paris Exhibition has set many imitators in motion and, in addition to one proposed near London, a company with, it is recently reported, Col. North as chairman has now been formed to build an Eiffel tower at Douglas, Isle of Man, and also a suspension bridge to connect the tower with the promontory of Douglas Head. The height of the bridge above the harbor will be 135 feet, allowing clear space for vessels of the largest tonnage to enter the harbor. The approach from the town will consist of a large circular tower with spiral roadway inside leading up to the level of the bridge, and this will be surmounted by an iron tower built upon a similar principle to that of the Eiffel. The proposed height of the tower is 400 feet above the sea level, and both the bridge and the tower will be illuminated at night by electricity, and a powerful arc lamp on the summit of the tower will light up the whole bay. The plans having been already deposited for the consideration of the Manx legislature, sittings of which take place chiefly in the winter, it is expected that the scheme will come under notice and discussion in the next few weeks.

Considerable speculation has taken place during the last few days in electric light shares in anticipation of the city corporation's decision as to the lighting of that portion of London under their jurisdiction. Should gas be superseded there is no doubt that shares in the electric light companies chosen will rise very considerably, and although the matter has not yet been definitely decided, sufficient feeling on the subject has been shown to satisfy good judges that the party in favor of electricity will have a considerable majority.

The readers of the ELECTRICAL REVIEW will be glad to have as complete particulars as possible regarding the various tenders submitted for the electric lighting of the city of London, and will thereby be in a position to judge what progress has been made in that industry during the last few months in this country. Tenders were sent in by five different companies, viz: The London Electric Supply Corporation, the House to House Electric Supply Company, Messrs. Laing, Wharton & Down, Metropolitan Electric Supply Company, and the Brush Company, and these were submitted to the streets committee of the committee of sewers, who obtained reports thereon from their electrician, Mr. W. H. Preece, and their engineer, Mr. Haywood, and from these reports I am able to give you the following information as to the various companies' offers:

The London Electric Supply Company specify arc lamps, 500 watts; glow lamps, 100 watts of such description as would best suit purpose required and the best possible to be procured. The generating station is situated at Deptford, and the main conductors would enter the city at Cannon street and Blackfriars Bridges. The system adopted would be the high pressure alternate current, and the lighting would be commenced as early as possible after statutory powers were granted. The price to be 3*s.* 6*d.* per unit of 10,000 watts to be supplied by meter and to include maintenance. (This unit is unusual, it generally being 10,000 watts which is the Board of Trade unit and which would make price 4*s.* 2*d.*) The current is to be charged by meter in general cases, but would not be absolutely bound to charge only in that way, and the company will be governed by the terms of their provisional order and by the Board of Trade regulations. In regard to penalties, payment would be made for substituted gas, so far only as the attendance to the gas lamps is concerned, and the penalties for failure are provided in the provisional order.

The House to House Electric Supply Company would supply focussing arc lamps suitable for alternating currents, each lamp consuming 500 watts, giving a nominal light of 2,000 c. p., or if the commission should prefer lamps of 280 watts and 1,000 nominal c. p. The lamps to be run on parallel from two separate circuits, each alternate lamp being on a different circuit and only the street lighting to be done from these circuits. It is not stated from what station the company would work nor where the conductors would enter the city. High pressure alternate current system would be adopted, and the public lighting of the main streets would commence within three months of the contract being signed and be completed within 12 months. The other portions of the district within nine months of instruction to commence and authorization to lay down the mains in streets. The price to be for arc lamps of 2,000 c. p. consuming 500 watts, £45 for the year; 1,000 c. p., 280 watts, £25. Glow lamps, 200 c. p., 500 watts, £45; 100 c. p., 250 watts, £22 10*s*; 50 c. p., 150 watts, £14; 16 c. p., 50 watts, £4 10*s*. The current to be charged for by meter payable quarterly on a sliding scale varying with maximum supply, viz: At the rate of 1*s.* per Board of Trade unit of 1,000 watts for the first 100 hours consumption of maximum supply; at 8*d.* per Board of Trade unit for the second 100 hours, and at 4*d.* per unit for any further quantity consumed. As to the penalties the company suggest that the aggregate penalties for one day are not to exceed £50, and that none at all should be inflicted where the failure was so slight as not to materially affect the value of supply, or if due to causes beyond the company's control.

Messrs. Laing, Wharton & Down offer Thomson-Houston arc lamps of 2,000 c. p. nominal, 500 watts each, with current of 10 amperes. Do not propose glow lamps in main streets, but would use in side streets and courts in series of 32 and 64 c. p. Would not erect a generating station in the city, and the conductors would enter at Aldgate, Fenchurch street and Cannon street station. The high pressure direct system would be used, and work would be commenced within three months of the contract being signed, the main streets to be lighted within 15 months. Other portions of district to be started as soon as 50 lamps are ready and added to 50 at a time; the whole district to be lighted within three years of contract being signed. The price to be for arc lamps, 2,000 c. p., £30 for the year estimated at 3,750 hours lighting required, and for glow lamps for the same period, 64 c. p., £12; 32 c. p., £7. Extra hours to be in proportion. The prices respectively to be reduced to £26, £10 and £5 if certain modifications in the specification which they suggest should be granted. To be charged for current by meter at 8*d.* per Board of Trade unit or by agreement based upon that price. Messrs. Laing, Wharton & Down also propose a sliding scale for penalties—1*d.* per lamp per minute and not to exceed 5*s.* per lamp per night.

The Metropolitan Electric Supply Company specify 2,000 candle power arc lamps, taking 10 amperes of current and energy required 500 watts per lamp. A generating station is proposed at Greenore wharf on Surrey side of river Thames, near Blackfriars Bridge, and another at Sardinia street, Lincoln's Inn Fields. Would use high pressure alternating system for arc lamp circuits, and would have all distributing mains and boxes laid within 18 months of confirmation of agreement. The price would be 6*s.* 8*d.* per unit of 10,000 amperes, equivalent to 8*d.* per Board of Trade unit for the private lighting. For the public lighting the tender is 3*d.* per unit. The annual charge for each arc lamp to be £30, which would be reduced to £26 if certain suggested modifications were accepted. The current to be charged by meter at 8*d.* per unit, or by an agreement of 30*s.* per annum per lamp for a continuous supply, or 25*s.* for an intermittent supply during 18 hours each day. The Metropolitan Electric Supply suggest a similar scale of penalties to that proposed by Messrs. Laing, Wharton & Down.

The Anglo-American Brush Corporation tender arc lamps: Brush double carbon lamps taking current of 10 amperes at 50 volts; 2,000 nominal candle power and energy required for each 500 watts; glow lamps for the chief narrow streets to be worked in series with the arc lamps; current, 10 amperes (20 volts); energy per lamp, 200 watts; candle power, 64 actual; glow lamps for the ordinary narrow streets, lanes and courts to be worked in series with the arc lamps; current, 10 amperes (10 volts); energy, per lamp, 100 watts; candle power, 32 actual. The generating station to be outside the city; the conductors to enter by the thoroughfares on the north and bridges on the south. The system used will be the high pressure direct for public lighting and the direct current battery system for private lighting. The prices to be: Arc lamps, £30 per annum; glow lamps, 200 watts £13 per annum; glow lamps, 100 watts, £7 per annum. To be reduced to £26, £10, and £5 respectively, should certain modifications in the specification be adopted. The main thoroughfares to be commenced within three months of signing contract and to be completed in 15 months. The other streets to be commenced as soon as possible after the main thoroughfares are completed; the lighting to be put in operation at the rate of 50 lamps every three months, and the whole to be finished in three years from signing contract. The current is to be charged by meter rate 8*d.* per unit of 1,000 watts. The consumer must pay for a minimum consumption of 50 units per annum on each ampere capacity of his meter. The hours during which the lamps are to be lighted as fixed by the committee were agreed to by all the companies tendering.

The Thomson-Houston Company intend to push their business of electric traction in this country, and as there is a very considerable field this pioneer firm should reap a rich result for their enterprise.

At the London Institution, Finsbury Circus, London, E.C., the following lectures, interesting to electricians, have been announced: Nov. 18th, 1889, Col. Gourand, "The Phonograph." Jan. 27th, 1890, Professor A. W. Rücker, M. A., F. R. S., "Electrical Forces." Feb. 10th, 1890, Shelford Bidwell, M. A., F. R. S., "Electrical Phenomena in Nature." March 6th, 1890, Dr. B. W. Richardson, F. R. S., "The Birth of Great Inventions and the First Electrician."

Messrs. Woodhouse & Rawson, Limited, advise me that their business has so largely increased that more commodious premises have become necessary, and that the firm will remove next month from 11 Queen Victoria Street, E. C., to 30 Cannon street, London, E. C.

CHARLES FFRENCH.

London, October 30.

.... The *Standard's* Shanghai dispatch says that Le Hung Chang is working to secure the ratification of the Che Foo telegraph convention. The American minister earnestly protests against the convention.

Synchronism in Multiple Telegraphy.

[Written for the ELECTRICAL REVIEW, by GEORGE EVARI-TE MORSE, of Washington, D. C.]

Although multiple telegraphy is an art of recent growth, synchronism, upon which it chiefly depends for its operativeness, is comparatively an old one; occasion for its use having arisen out of the necessity of obtaining absolutely uniform motion of the writing pens, in the old writing telegraphs of Bain, D'Arlingcourt, Casselli and others. In these and other systems the message was written on tin foil with insulating ink, and the foil with the message was spread upon a surface of some kind, often on a cylinder, which was rotated beneath a transmitting pen or style, and at the same time given a longitudinal motion so that the pen traversed its entire surface. Circuits were established through the cylinder, foil and pen to the receiving station, at which place was a similar pen and cylinder, but instead of the foil a chemically prepared paper adapted to be discolored by the passage of an electric current was spread upon the cylinder. As the transmitting pen passed over the tin foil the current would decompose the compound with which the paper at the receiving station is impregnated, but when the pen ran over the insulating ink, the current would be interrupted and a dark line left on the paper corresponding to the insulating ink. It is evident that unless the pens at each station moved uniformly, the lines of the received message would be distorted and irregular. The only remedy was absolute synchronism in the motion of the cylinders. Bain, the earliest inventor, regulated his mechanism by two pendulums, one at each end, which were caused to run on a circuit closing spring-catch at one extremity of the arc. If both moved together a circuit was closed, which withdrew the catches from the path, but if one moved faster than the other it would be held by the catch until the other had closed its end of the circuit, when the catches would be withdrawn and both would start together. Another inventor sends an impulse to line at each beat of the pendulum, which releases a stop on the cylinders, which then make one complete revolution. The same inventor in another device rotates the cylinders, and when the apparatus runs out of synchronism an impulse is sent which releases the connection between the motor and the cylinder shaft, and the faster cylinder stops until the slower catches up, when they both move together. There are also numerous devices for permitting one cylinder to rotate faster than the other, and arresting it at every revolution until the other catches up. In another device a pole changer puts alternate poles to line through both instruments, and gives an intermittent rotary motion to the cylinders. As both make a definite regulated movement at each reversal synchronism is obtained. Lenoir describes a device in which current from the transmitter is led through a commutator on a shaft, which carries fans to regulate the motion. Mounted on a similar shaft in the receiver are radial arms of iron or steel which pass in proximity to the poles of an electro-magnet. The commutator (supra) is so arranged that an impulse is sent through the coils of the electro-magnets when the radial arms are exactly above them. Any variation of speed will thus be corrected, acceleration if slow and retardation if fast, by the action of the magnetic field, should the impulse come when the arms are coming on or going off the poles, or are in any position but exactly above them. Before I pass to the more recent devices, for synchronizing multiplex telegraphs, I will describe the phonic wheel of Poul La Cour. This consists of an ordinary horse-shoe electro-magnet placed in proximity to the periphery of a toothed iron disc hollowed out and filled with mercury to make the motion uniform. A pulsating current is sent through the magnets which, at each pulsation, attracts up the successive iron teeth and produces a motion of rotation. The current interruptions are caused by the tines of a turning fork rapidly opening and closing the circuit. A local circuit through magnets, actuating and governing the fork, is also caused to be opened and closed by the same means. The forks at the transmitting and receiving stations have both the same rate of vibration, and consequently will produce both the same rate of revolution. This, although devised for a printing telegraph, is equally applicable to multiplex, which consists, as is well understood, in giving the line in succession to one operator after another. This is accomplished by having a circular table consisting of alternate conducting and insulated segments. Connection is made between the operators' instruments and the conducting segments. A trailer arm mounted on a rotating spindle connected to line is caused to sweep rapidly over the table, thus giving each operator in succession the line for a brief period, the motion being so rapid that each operator is practically in connection with the line at all times. The system of Delany is practically built on this foundation. In the earliest patent to himself and Callahan, a similar arrangement of vibrating circuit breaker and motor is shown. In one modification there is a separate line connecting the magnet coils of the motors, and thus the same actuating impulses are used in both. In another there is no line for synchronizing, but a synchronizing impulse is sent through every 10th segment, which are ordinarily placed at a distance of $\frac{1}{8}$ of a revolution apart. In the patents to himself, Delany states that he may use a table of 60 contacts connected up into six groups of 10 each, numbered from 1 to 10. The 9s and 10s of each group are used for synchronizing in the following manner: For brevity, the terminal stations will be called X and Y throughout. At station X three 9s most remote from each other are connected together and to a correcting battery. At the same station three 10s, most remote from each other and from the connected 9s, are connected through corrector coils on the vibrator magnet. The remaining 9s and 10s are thrown out or unconnected. At station Y the 9s, corresponding to those connected to the battery at X, are thrown out, while the alternate 9s which correspond to those thrown out at X are connected with the correcting battery at station Y, and the 10s at station Y which are connected with each other and the correcting coils on the vibrator magnet at Y correspond to those thrown out at X, the 10s at station Y corresponding to the connected 10s at X are thrown out or unconnected. At both stations the number 10 contacts, which are connected to the correcting coils, are built out or extended towards the adjoining 9s which are not connected with any circut. Should the apparatus at Y move a little faster than at X, the finger will get on the extended part of a 10 contact while the finger at X is on a 9, and the current will be sent through the correcting coils which increases their magnetic force and causes them to act on the vibration, increasing the amplitude of its vibration at the expense of the rate. In another patent Delany states that he prefers to have in the fork at Y a tendency to run faster, rather than slower than X, but should the rate of X exceed Y, he has placed on Y a small contact $8\frac{1}{2}$, next to one of the 9s, which ($8\frac{1}{2}$) is connected to an accelerating magnet placed between the tines of the vibrator fork. The trailer will rest on this contact $8\frac{1}{2}$, while the trailer at X is on a 9, and a current will be sent energizing the magnet and heightening the rate of vibration. In another case he has connected all the 9s at each station together and to battery, and all the 10s together and to correcting coil on the tuning fork. From these connections it follows that when one trailer rests on a 9, and the other on a 10, a correcting impulse is sent over the line. When both rest on 9s, the batteries being put with opposite poles to line, oppose each other and there is no current. When both trailers rest on 10s, there is no battery on line. Instead of having correcting coils on the vibrator magnets, he may, as shown in his various patents, cause the correcting current to adjust the pole-pieces of the vibrator magnets, which are made adjustable for that purpose, so as to regulate the strength of the field. Or he may by relays or analogous devices close a short circuit around resistances placed in the local vibrator circuit, or entirely interrupt the current through the motor magnets. He prefers to correct only at one station and have the other fork entirely undisturbed. Means are also shown for accelerating one and retarding the other, at the same time. Other inventors place a series of electrically controlled detents in the path of the trailer arm, which are successively removed as the circuits are completed in order. Should the apparatus run out of synchronism, the faster trailer will be stopped and held, until the slower catching up there will come an impulse to remove the detent and free the arm. Rogers, in his "visual synchronism," places on the shafts of both motors commutators whose corresponding segments are connected by wires, so that when in synchronism impulses are sent through both commutators, and an electro-magnet mounted on the motor shaft. On the armature of the rotating magnet there is placed a mirror. When the image of a candle or other source of light is thrown on the rotating mirror, it will appear as an unbroken ring of light. The play of the armature between its stops, caused by the impulses of current, will cause nibs to appear on the ring in the mirror. These nibs should appear at equal intervals, and by placing a pointer where one of them ought to appear, it may be ascertained by the displacement of the nib when the apparatus is not in synchronism and it may be regulated accordingly. Cassagues uses a fork at which governs the speed by interrupting the current through the armature of an ordinary electric motor which rotates the trailer. At station Y is another motor and two tuning forks of different rates, one slightly faster and one slower, than the fork at X. These forks are thrown into operation in a manner presently to be explained, and make and break the motor circuit in the same manner as the fork at X. One fork responds to negative currents and the other to positive. A polarized relay closes circuits which send currents of corresponding polarity through appropriate forks, according to the character of the impulse sent from X, to throw either the fast or slow fork into operation. The character of the impulse transmitted is regulated in the following manner: Two adjoining contacts on the table at X are connected to two batteries with opposite poles to line. Corresponding space on Y is divided into three small contacts and the middle one connected to the polarized relay. Should Y run out of synchronism, the trailer will be on this middle contact while the trailer at X is on one or the other of the battery contacts. An impulse will thus be sent through the relay to throw one or the other of the forks into vibration and correct the speed of the motor. Patten, in the most recent improvement, works on the principle that the telephone is a synchronous alternate current motor. The transmitting diaphragm (field) producing alternate impulses in the coil (armature) and line, and the receiving diaphragm (armature) responding to mutations of current in the coil (field) repeating the motions of the sending diaphragm in perfect synchronism. Following this he has placed electric motors at each terminal to rotate the trailer. Upon the back of the armature spindle of one motor two insulated conducting rings are placed, to which is connected one end of each of the two armature coils. Brushes bear on these rings, and it is obvious that at each half revolution the current is reversed through the coils, and a complete alternation will be made at each revolution. This alternating current is taken off by the brushes that bear on the rings, and is shifted by polarized relays, to the line, and from the line to the receiving station where it is led around the field of the motor. The armature of this moto consists of two Siemens shuttle-wound coils placed at right angles to each other, and supplied by a source of constant current. A half revolution will thus be made at every reversal of the polarity of the field caused by the alternating current through the coils, and since the current reversals are one for every half revolution of the governing motor the apparatus will run in perfect synchronism. The same inventor also shows a method of mechanically reversing the current by placing alternate battery poles to alternate segments. The trailer, sweeping over the table, comes upon the alternate contacts and puts alternate poles to line. Such is briefly the systems of synchronism as practiced today, and although susceptible of great improvement will remain as a monument to the men who have fostered the growing art of telegraphy.

The Missouri and Kansas Telephone Company.

President Mulvane has issued the following statement to the stockholders of the Missouri and Kansas Telephone Company, dated at Topeka, Kans., November 1, 1889:

Herewith find statements of the earnings of your company for the quarter ending September 30, 1889, and also for three-quarters of 1889.

We are much gratified with the fine showing we make for third quarter. We have completed during the quarter and opened exchanges at Warrensburg, Mo., and Hutchinson, Kans. We have also completed a metallic circuit from Kansas City to Warrensburg, Mo., expecting during the fourth quarter to extend this to Sedalia, Mo. With the general revival of business from the good crops in our region, we hope to continue the good showings of the second and third quarters. Our expenses for the fourth quarter must of necessity be large, as we are replacing with cable and copper wire as many of our weak lines as possible, so we may give our patrons good winter service. While we do not look for a recurrence of last year's disasters, yet the painful memory is still with us, and we are hedging against a like misfortune.

Your board of directors increased the dividend to $1\frac{1}{4}$ per cent. for the quarter ending September 30, thus bringing the average dividend up to one per cent. per quarter for 1889.

Treasurer N. R. Ferguson gives the following statement of the earnings of the company for the third quarter, ending September 30, 1889:

Gross earnings		$105,575 48
Gross expenses	$76,223 10	
Net earnings for the quarter	29,352 38	
		105,575 48
Gross earnings for three-quarters		311,981 57
Gross expenses	$251,511 56	
Net	60,470 01	
		311,981 57
Divid'd paid, 1st quarter, ¾ of 1 per cent.		9,094 50
Dividend paid, 2d quarter, 1 per cent.		12,126 00
Dividend paid, 3d quarter, 1¼ per cent.		15,182 50
		$36,403 00
Cost of construction to date		25,775 43
Cost of repairs for quarter		17,361 98
Included in gross expenses.		
Subscribers added		520
Subscribers discontinued		339
Net gain for the quarter		181
Present number subscribers		6,575

.... The Postal Telegraph Company has opened an office at San Francisco, Cal. The Western Union has also a new office in the Wells-Fargo Express Company's building of that place.

TELEGRAPHIC

.... E. L. McLean, of Ogdensburg, N. Y., has been appointed manager of the United Lines Telegraph Company in Oswego, vice S. L. Parsons, who has moved to Watertown.

.... The French cable now connecting at North Eastman will be landed at Rockport, Mass., in a few weeks. It will be run into the cable house at Cape Hedge, and new instruments will be put into the Commercial Cable Company's office, the companies having combined.

.... The Western Union Telegraph Company have purchased the telegraph line of the Georgia Pacific Railroad, extending from Columbus to Atlanta. They took possession last week and will at once put up three or four additional wires, and open offices at all the principal stations along the line.

.... The Department of Awards, Pittsburgh, met recently and awarded the contract for repairing the electric wires to the Gamewell Company, of New York, for $9,135. The contract for the chamber was awarded to Jacob Schneller, for $2,400. There were three bidders, Mike Gallagher, who bid $4,700, and Booth & Finn, who bid $3,450.

.... Builders are erecting three more telegraph lines between Macon and Atlanta, Ga., two for the Central railroad and one for the Western Union. New wires are also being erected between Macon and Savannah. The business of the Western Union at Macon has increased so largely the past two years that ten additional wires have already been built.

.... A late french invention consists of a thermometer with a scale about eight inches long, reading from 0° to 30° centigrade. The bulb holds mercury as usual. A platinum wire of about .0008 inches in diameter runs from end to end of the tube, being connected with platinum terminals fused through the glass. The length of wire between the above-mentioned scale of degrees has a resistance of 200 ohms. The resistance of the whole thermometer, therefore, will vary considerably as the mercury rises and falls in the tube, and it is on this that the arrangement for telegraphing the temperature to a distant point depends. The receiving instrument consists of a low resistance galvanometer and an auxiliary resistance of about 200 ohms. Two cells connected in parallel are employed to send a current through the thermometer, resistance, and galvanometer, the deflection of the latter indicating the height of the mercury in the thermometer tube.

.... R. R. Dobell, of Quebec, promoter and projector of the Canada Atlantic Cable Company, says that every arrangement so far necessary has been perfected, and that the cable is a solid fact. Work will be commenced next year and will be pushed forward vigorously. The capital expenditure of the company is estimated at $1,600,000. One of the principal manufacturing companies of London has offered to provide, lay and guarantee a cable of the most approved type for $1,500,000. The company's lines will thus cost one-fifth less than any of the Anglo-American cables, one-quarter less than the Direct United States, Western Union and Compagne Francaise lines, and one-quarter less than that of the Commercial Company's connection. The Canada Atlantic cable will extend from near Clew Bay, in Ireland, to Greenly Island, in the straits of Belle Isle. The cable will be 1,900 miles long. Dangers to be met with from icebergs grounding in this northern region are not feared. The object in having the cable laid so far north is that it will be absolutely free from risks during repairs of other cables and can be more easily raised when required. The other cables are all close together and are sometimes crossed. The Canada Atlantic line will be laid 150 miles north of any of these.

* * The formal opening of the Thomson-Houston Company's electric railway between North Adams and Adams took place a few days ago.

* * Mr. S. P. Ellis, manager of the Johnstown (Pa.) Street Railway Company, having obtained the contract for the construction of an electric railway at Greensburg, Pa., began work last week.

* * The citizens of Jacksonville and Medford, Ore., have raised a subsidy of $20,000, and the Jackson County Electric Light and Power Company has agreed to put in a lighting plant and build an electric railroad between the two towns. The road is to be three foot gauge, and to be in running order by May next.

* * The work of wiring for the street railroad at Columbus, Ohio, has been completed. A single wire above each track carries the current for the propulsion of the cars. The work has been done by the Short Electric Railway Company in the latest and most approved manner.

* * The Thomson-Houston Electric Company, of Boston, has begun proceedings in the United States Circuit Court against the East Reading Railroad Company and its officers at Reading, for alleged infringement on the plaintiffs' patented improved current collecting device for electric railways.

* * A deal has been recently consummated at Nashville, Tenn., by which all of the street railway lines in the city will be consolidated under one management, the capital stock being about $3,000,000. About 50 miles of road are included in the deal. All the lines will be operated by electricity.

* * Boston capitalists have visited Greenwich, N. Y., with the intention of erecting an electric light plant at Middle Falls and extending the wires to Greenwich and Schuylerville for street lighting and commercial purposes. In connection with the electric lights an electric railroad for passengers and freight has also been broached and meets with general approval.

* * The work of putting up the poles for the overhead wires for the Mt. Oliver Electric Railway, Pittsburgh, Pa., has been completed. The road will be started again early next week. When $6,000 had been expended by the company in endeavoring to put the wires underground without securing satisfaction it was abandoned, and an ordinance was presented in Councils, and passed, granting the right to use the overhead system.

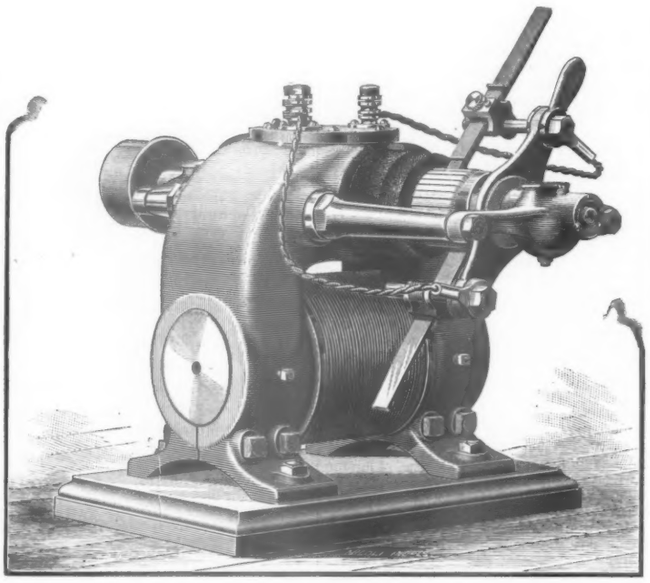
* * The gross earnings of the West End Street Railroad Company, Boston, Mass., for the year ending September 30, 1889, were $5,165,000. Dividends did not accumulate upon all the $1,500,000 of common stock now outstanding, but after the payment of $102,500 in dividends on common stock there remains a surplus of about $110,000. Charged to the construction account are the cost of 200 new cars and about $800,000 spent for electrical development, some of which was for real estate.

* * A company has been formed with a capital stock of $50,000 for preliminary operations to connect an electric railway from Boston to Salem by way of Lynn. The board of directors, as chosen, consists of Henry W. Savage, Simon H. Hathaway, of this city; Frank H. Hills, of Newton; Frank W. Atkins and J. C. Bennett, of Lynn; and Edgar S. Buffum and Albert H. Patten, of Salem. Besides these, the following gentlemen are named as stockholders: Mason G. Parker, Alonzo B. Wentworth and William F. Rich, Boston; Herbert W. Cook, John McLay, George O. Fall, Fred. E. Parker and Ira B. Kieth, of Lynn, and A. Goldsmith, of Salem. The distance over the route proposed is 17 miles, and such a road would, if built, be brought into direct competition with the steam railroad.

The New Electric Motor of Charles D. Jenney.

The accompanying cut illustrates the form of Jenney motor and dynamo used for sizes less than ten horse-power. This machine is widely different from those in general use; the armature, field magnet and shape of pole pieces being its characteristic features.

The inventor has aimed to produce a magnetic field of great strength, which will, at the same time, be economical to maintain. By studying the direction of the magnetic lines of force about a straight bar magnet, the inventor was led to design the form of magnet shown. The natural direction and curvature of the lines of force, as they pass through the air from one pole to the other in a bar magnet, are well known. In this machine the pole-pieces were made to correspond with the natural curvature of the lines of force, thereby reducing to a minimum the length of the magnetic circuit and its resistance. The magnet core is made of the softest of wrought iron, and is turned back from each end the same diameter to which the pole-pieces are turned. There are slots in the lower ends of the pole-pieces, so that by means of bolts they are firmly clamped to the core, thus securing a most perfect magnetic union.



The New Jenney Electric Motor, Indianapolis, Ind.

The armature is wound with the greatest care, and so insulated that there is little danger of "short-circuiting" and burning out. The core is built up of thin iron disks, all of which are securely fastened to the shaft. The ends of the armature and the electrical connections are thoroughly covered, thereby protecting them from copper dust or dirt of any kind. The commutator sections are made of phosphor-bronze, and are insulated with mica.

The shaft is made of a fine grade of steel, and runs in journal boxes provided with interchangeable sleeves of phosphor-bronze. These machines are provided with self-oiling bearings, and will run for weeks without attention.

*** The story is told of a gentleman employed at a colliery a few miles from Glasgow who had a dog called Jimmy, which he parted with to a friend at a colliery some miles distant. The two offices are connected by telephone, and the other morning the gentleman rang up his friend and asked how Jimmy was doing. "Oh, he's fine," was the answer. "He's at my feet just now. I'll hold him up and see if he knows your voice." This was done, and the former owner shouted over the wire, "Hillo, Jimmy!" Jimmy made no sign of recognition, but on being set down again he at once made for the door, and when his old master went home to dinner the dog was there to welcome him.

The Growth of the Telegraph Business.

In 1870, less than 25 years ago, the telegraphic record of the Western Union Telegraph Company showed 112,191 miles of wire and 9,000,000 messages sent. This year the mileage of wire is 647,697 and the number of messages sent 54,000,000. Every country in the world which aspires to be grouped with the civilized nations of the world has, within the last 25 or 30 years, adopted the electric telegraph as the method of speedy communication, and the deserts of Africa and the vast steppes of Asia are punctuated with the wire-bearing poles. At the close of 1880 the mileage had increased to 300,000 miles, and the messages numbered 33,155,991. The majority of the business of the Western Union has been the transmission of press dispatches, and to the newspapers of the country are sent annually from a billion and a half to two billions of words. This vast business is supplemented by an ever-increasing private business, the celerity of whose performance has been promoted, of course, by the recent advances in telegraphy, the perfection of the automatic system and the development of the duplex and quadruplex systems.

Lansing, Mich.—The Electrical Invention Company, with an alleged paid up capital of $100,000. The incorporators are Thomas H. Hicks, Homer Pennock, Peter Duffus, Salem Johnson and Elkana D. Richmond.

Norfolk, Neb.—At a meeting of the directors of the Norfolk Electric Light Company it was decided to increase the authorized capital stock to $20,000. The present paid up capital is $15,000. $2,000 worth of the new stock is to be put on the market at once, for the purpose of putting in an arc light plant.

Lynn, Mass.—Newly elected officers of the North Shore Electric Light Company, of Lynn, Mass.: President, B. F. Peach, Jr., of Lynn; treasurer and clerk, Thomas T. Robinson; directors, B. P. Peach, Jr., Thomas P. Robinson, George F. Proctor, Irving B. Sayles, George W. Davenport, Lucius Floyd, Charles H. Thayer.

Bangor, Me.—The Butterfield and Mitchell Electric Cooking and Heating Company has been organized in Waterville with a capital of $500,000. The officers are as follows: President, J. T. Clarkson; treasurer, Wm. T. Haines; directors, H. R. Butterfield, Willis Mitchell of Waterville, J. T. Clarkson of Amesbury, Mass., and Wm. T. Haines of Waterville. The purposes of the corporation are the manufacturing and selling of apparatus for cooking and heating by electricity, and for the purpose of buying and holding and making any patent cooking or heating device or apparatus by electricity and for the sale of the same in any country, and to collect a royalty on any patent right or invention which it controls.

The Massachusetts Electric Lighting Association.

To the Editor of Electrical Review:

In the organization of State Electrical Associations, Massachusetts leads the country. The initial step which led to the consummation effected to-day was taken on the 21st of May, 1889, at which time a meeting was held in this city, composed of representatives of companies engaged in the business of electric lighting. The committee raised at that meeting to consider the advisability of forming a State Association, reported as follows:

"We regard the formation of such an Association as desirable from every point of view; indeed, we regard it as necessary to the protection of our mutual interests."

Pursuant to a call issued by this committee, a meeting of representatives of central station companies was held at the Tremont House to-day (November 7th), for the purpose of effecting a State organization. About 40 companies, representing fully $5,000,000 of capitalization, participated in the meeting. All systems of electric lighting are now operated daily by these companies; the arc and incandescent; the high pressure and low pressure; the continuous and alternating currents. This shows that the organization is cosmopolitan.

A code of by-laws was adopted and the following officers were elected: F. A. Gilbert, president, Boston; T. C. Bates, vice-president, Worcester; G. W. Fifield, vice-president, Lowell. Executive Committee: F. A. Gilbert, Boston; T. C. Bates, Worcester; G. W. Fifield, Lowell; C. L. Edgar, Boston; C. A. Nichols, Springfield.

Membership in the Association is limited to central station companies doing an electric lighting and motor business for commercial purposes. Gas companies doing an electric lighting and motor business in connection with their gas business may become members, and a number of such companies were represented in the meeting.

The objects of the Association are "to foster and promote the common interests of its members." The by-laws provide for co-operation with similar associations organized in other States, through the medium of a national association, in such manner as may hereafter be considered desirable.

The Boston Electric Light Company extended a cordial invitation to all persons present to dine with its officers at the conclusion of the meeting. This invitation needed no repetition, everyone's hearing seemed to be good and all appeared to understand what an enjoyable entertainment would be found in the cosey Tremont House dining room, to which Mr. F. A. Gilbert led the way.

A movement is being made to organize State electrical associations in all States. The work is being assisted and developed under the auspices of the "National Committee on Legislation of the National Electric Light Association." The necessity for such organizations is very clear to all who have given thought to the subject. All central station companies are incorporated under State laws. They occupy the territory in which they do business by virtue of municipal franchises, the tenure of which is controlled by State legislation. Through State legislation they acquire all legal rights, through State legislation all efforts to cripple or thwart their endeavors are made. Had there been a properly organized electrical association in the State of New York to look after proposed legislation, the laws requiring criminals to be executed by electricity, and creating a "Board of Electrical Control" in New York City composed exclusively of politicians (the Board has no electrician in its membership), would never have made New York the electrical plague spot of the country. The damage already done to the electrical industry by these two laws is simply enormous; such damage may be perpetuated if effective measures of prevention are not provided.

A. R. Foote,
Chairman National Committee on State and Municipal Legislation of the National Electric Light Association.

Boston, Mass., November 7, 1889.

Some Interesting Figures Relating to the Cost of the Electric Light.

Engineer Commissioner Raymond, of Washington, D. C., acting under the direction of an act of Congress passed at the last session, has been making long and careful investigation to determine whether any reduction can be made in the prices paid for public lighting, either by electricity or gas, on annual or five year contracts. The city is now paying the gas company $20 per year for each six foot burner for 2,600 hours illumination, and the United States Electric Company 60 cents for each arc light of 1,000 actual (2,000 nominal) candle-power, burning all night (about 11.74 hours), which is equivalent to $219 per light per year. There are 181 arc lamps in use, all on underground conductors, carrying a high tension current of about 2,500 volts. Both of these corporations are armed and equipped for determined opposition to all attempts to invade the position held by them. The gas company declines to make any reduction on one year contracts, but would take a five year contract at $19.50. President Norment, of the United States Company, informs Major Raymond that they have built an extensive system of most substantial conduits at great expense; are using the best lead-covered cables and have been subjected to a heavy outlay in renewing burnt-out cables, but they regard this work as experimental and believe that time can only determine whether the system will be successful. It has been in use too short a time to decide whether it can be maintained upon a basis of 60 cents per lamp. Mr. Norment declares that electric lighting is still in its infancy, that it is impossible to form any adequate idea of its actual cost, and that any reduction in the present price would be unwarranted.

Major Raymond has endeavored to ascertain what the proper price should be in two ways; first, by comparison of prices paid in other places, and second, by a theoretical estimate of the cost of production in this city. He has prepared a statement of the prices in 336 localities, from which it appears that the lowest price is $33 per light per year, burning to 12.30 A. M., and the highest is $280 for all-night lights; the average price for all and every night lights is 58.6 cents per night per light. From this data he concludes that the minimum price which can be justly paid for the underground arc light system is about 57.6 cents per night per light.

The following are the "all-night" prices at some of the principal places in the statement referred to:

CONTRACT PRICE FOR MUNICIPAL ARC LIGHTS, 2,000 CANDLE POWER.

Place.	Term of Contract.	Number of Lights.	Price per Light per year.
New Haven, Conn	3 yrs.	146	$171 55
Wilmington, Del.	3 "	33	164 25
Tampa, Fla	20 "	20	182 50
Atlanta, Ga	3 "	150	120 00
Columbus, Ga	3 "	40	108 00
Savannah		100	225 00
Texarkana, Ark	30 "	14	160 00
Pueblo, Col	5 "	100	156 00
Trinidad, Col	5 "	30	150 00
Indianapolis, Ind	2 "	100	60 00
Leavenworth, Kan		35	120 00
Louisville, Ky	1 "	50	233 60
New Orleans, La	4 "	948	130 00
Lowell, Mass.		182	182 50
Fall River, Mass		40	180 00
Salem, Mass	3 "	170	163 50
Springfield, Mass.	1 "	54	20 00
Worcester, Mass	3 "	170	200 00
Adrian, Mich	3 "	63	100 00
Albion, Mich.	1 "	33	135 00
Battle Creek, Mich		65	200 00
Detroit, Mich	3 "	673	178 85
East Saginaw, Mich	3 "	126	120 00
Grand Rapids, Mich	1 "	40	140 00
Jackson, Mich		194	88 81
St. Cloud, Minn.	1 "	24	125 00
Natchez, Miss	5 "	65	85 00
Kansas City, Mo.		65	200 75
Nevada, Mo.	20 "	16	125 00
Sedalia, Mo	3 "	20	125 00
St. Louis, Mo		2,250	75 00
Manchester, N. H.	3 "	240	142 35
Camden, N. J.	5 "	119	146 00
Salem, N. J	1 "	32	80 00
Trenton, N. J.	1 "	106	182 50
Albany, N. Y.	5 "	481	182 50
Brooklyn, N. Y.	1 "	1,106	182 50
New York City, N. Y	1 "	1,324	127 75
Poughkeepsie, N. Y.	1 "	210	123 00
Rochester, N. Y.	5 "	1,050	104 03
Syracuse, N. Y.	3 "	295	144 00
Carson City, Nev.		10	300 00
Dayton, Ohio	10 "	146	150 00
Springfield, Ohio	1 "	54	130 00
Steubenville, Ohio	5 "	23	75 00
Toledo, Ohio	5 "	400	100 00
Altoona, Pa.	1 "	32	98 00
Harrisburg, Pa	1 "	240	90 00
Lancaster, Pa.	3 "	138	124 00
Pittsburgh, Pa.	3 "	500	104 00
Providence, R. I		247	182 50
Nashville, Tenn.	3 "	150	82 77
Rutland, Vt	5 "	56	280 00
Ellensburg, Wash	50 "	7	180 00
Milwaukee, Wis	3 "	185	150 00
Montreal, Que.	5 "	135	146 00

Not being satisfied that the experience in other localities is of any great value in ascertaining the cost of lighting in this city, and having no power to require the local company to furnish information, Major Raymond, in order to arrive at a more reliable result, has prepared the following estimate of the cost of such a plant as is now operated by the United States Company at Washington, with a capacity for 350 arc lamps (1,000 actual c. p.), and 4,000 incandescent lamps (16 c. p.):

COST OF STATION AND PLANT.

Land	$30,000
Buildings	20,000
12 4 miles conduit ($11,000 per mile)	136,400
Lamp-posts and heads	4,500
Office and store-room fittings	1,000
Boilers, engines, dynamos, etc.	126,000
16 miles arc light cables ($1,000 per mile)	16,000
2.56 miles incan. light cables ($1,900 per mile).	4,861
2.94 miles incan. light cables ($4,070 per mile).	9,117
	$337,881
Superintendence and labor per year	17,130
Coal, 3,988 tons (5 lbs. per h. p. hour), at $3.25.	12,961

RUNNING EXPENSES.

Labor and salaries	$17,130
Maintenance	3,500
Taxes	732
Water	600
Insurance	375
Coal	12,961
Oil, waste and sundries	2,549
	$37,647

DEPRECIATION.

Buildings, etc., 5 per cent	$8,095
Machinery, 10 "	12,600
Cables, 15 "	4,497
	$25,192
Interest on capital, 6 per cent	$20,400
Cost per horse power hour	4.66 cents.
Cost of municipal arc lamp per annum, 4,986 hours at 4.66 cents per hour	$199 73
Carbons	15 40
	$215 13
Cost of arc lamp per night	58.94 cents.

New Electric Light Business.

The constant and growing demand for the electric light is well evidenced by the following list of sales of the Thomson-Houston Company, sent us by our Boston correspondent:

The Thomson-Houston Electric Company reports the following sales of incandescent apparatus to local companies:

Van Wert, O.	300
South Pittsburg, Tenn.	300
Columbia, S. C.	500
Mt. Vernon, N. Y.	1,300
Cincinnati, O.	1,300
Salem, Mass	650
Mt. Vernon, Ind.	650
Hudson, Mass.	650
Lancaster, N. H.	650
Turner's Falls, Mass	650

The same company reports the following sales of arc apparatus to local companies:

Mt. Vernon, Ind.	50
New Philadelphia, O.	100
Spokane Falls, W. T.	50
Seattle, W. T.	100
Stonington, Conn.	30
Salem, O.	30
Birmingham, Ala.	50
Mt. Vernon, N. Y.	100
Middletown, N. Y.	50
Tuscaloosa, Ala.	50
Columbus, O.	100
Upper Sandusky, O.	50
Somerville, Mass.	200
Oshkosh Electric Light & Power Co., Oshkosh, Wis	30

The same company reports the following sales of arc and incandescent apparatus for isolated plants:

	Arc.	Inc.
Phila. & Reading R.R., Reading, Pa.	20	
O'Donnell, Spencer & Co, East Saginaw, Mich		200
Carnegie, Phipps & Co., Munhall, Pa.	70	
Washington Mills, Lawrence, Mass.	50	
E. Mansfield & Co., Orino, Me		35
Aber Joyle Man'f'g Co., Chester, Pa.	50	
H. Twitchell, Union City, Conn.		50
Syracuse Steam Heat & Power Co., Syracuse, N. Y.	50	
Wineman Bros., Upton Station, Tenn.		50
Crandal Typewriter Works, Parish, N.Y.		50
Henry Newhall, Danvers, Mass.		50
Bradley Leather Fabric Co., Reading, Mass.		50
J. S. Crane, Lake Village, N. H.		100
Day Cordage Co., East Cambridge, Mass.		50
Hockanun Bros., Rockville, Conn.		100
V. K. & A. H. Jones, Lynn, Mass.		200
A. N. Wilson, Watertown, Conn.		200
earle, Dailey & Co., Medfield, Mass.		600

—— It is expected that the Schuyler Company will receive the contract for lighting the streets of Alexandria, Va. The 60 days' trial which the city has been giving the system of that company will expire on 17th prox.

—— The Edison Electric Light Company of Williamsport, Pa., has signed the contract by which they come into possession of the steam heat plant. The steam heat plant will use the exhaust steam from the electric light station.

—— The Pond Engineering Company have furnished the American Electric Light Company, of Kansas City, with a 50 horse-power Armington & Sims engine, and the Empire Cordage Company, of Champaign, Ill., with a 15 horse-power Gardner vertical engine for driving their isolated Edison plant. They will furnish and erect two 150 horse-power boilers complete, with Pond Engineering Company setting for the St. Louis Smelting and Refining Works.

Big Incandescent Lamp Business.

The Westinghouse Electric Company received orders for central station alternating current dynamos for 30,250 16 candle-power incandescent lamps capacity during the month of October, distributed over 25 central station plants. This is the largest amount of business ever done by the company in the same period of time, being an increase of over 2,000 lamps over the work done in September.

Among the many contracts awarded to the company lately, is one for Allegheny City, Pa., for apparatus for a 3,000 alternating current light plant; another for a similar plant in West Superior, Mich., and again another also for 3,000 lights in Havana, West Indies.

The latter is an extension of a plant which the company put up a year ago.

—— It is said that J. P. Smith, of Minneapolis, will put in a $15,000 electric light plant at Independence, Iowa, and has secured a ten years' franchise.

—— The Sawyer-Man Electric Company reports having unfilled orders for over 100,000 lamps, although running their factory at 510-534 W. 23d street, this city, day and night. They are advising their customers to order at least two weeks in advance of requirements on account of the heavy demand for lamps. Who says the electric light business is not booming?

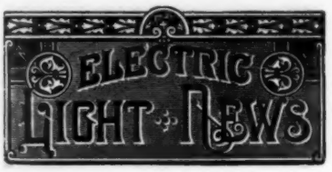
—— Within the next month the new incandescent electric light system, for street and house use, will have been completed and in operation by the Denver Electric Illuminating Company. Denver, Colo., and another chapter will have been added to the city's progress toward metropolitanism. The new system will start out with a service of 650 lamps, which may be increased to 10,000 before the limit of capacity is reached.

—— A gentleman who arrived in Hartford, Conn., last week from a trip abroad, brought over an electric lantern, manufactured by J. Pitkin, London, which is the only one on this continent. It consists of a battery in small compass with an incandescent light inclosed in a small globe. It gives a strong light. The manufacturer stated that a cartridge factory in Bridgeport has ordered two of these lanterns, as there will be no danger of an explosion in their use.

—— Mr. Geo. W. Silsby, of the Edison United Manufacturing Company, has sold the following recently: C. W. Hunt Co., Staten Island, 150 sixteen candle-power lamps; Jamestown Worsted Mills, Jamestown, N. Y., 1,000 sixteen candle-power lamps; Bloomfield, N. J., 500 thirty candle-power Edison municipal. The domestic plant will be 1,000 sixteen candle-power. Work on Hackensack (N. J.) central station is nearly completed, and current will be turned on about November 1st.

—— At a recent meeting of the newly incorporated West Troy (N. Y.) Electric Light Company, officers were elected as follows: George H. Moseman, president; George W. Hunt, secretary and treasurer; directors, Mr. Toller of New York, Mr. Lindsay of Brooklyn, and John Gallagher of Lansingburgh. The work of establishing an incandescent plant will be rapidly forwarded. A large number of subscriptions for commercial lights have been received.

—— The old joke of a man stealing a red hot stove has often been worked on the stage, and always evoked hearty applause because of its seeming improbability, says the Augusta (Ga.) *Chronicle*. An affair has just transpired in Augusta, however, which almost discounts the stove theft. It is the stealing of an electric light while actually in service. It must certainly have been some one well versed with the manipulation of electricity as applied in lighting, for the trick was accomplished just as if done by an employé of the company, had he been ordered to do so. The switch was first used to divert the current, the lamp was lowered and secured, and then the circuit was again completed by means of the switch.



—— Merrill, Wis., has entered into an eight year contract with its electric light company.

—— The Louisville, Ky., Gas Company is contemplating the erection of a large electric light plant.

—— Toward starting an electric light plant at Bristol, N. H., $5,000 of the $8,000 necessary has been subscribed.

—— The natural gas supply of Scottdale, Pa., being shut off, a movement is on foot looking to the organization of an electric light company for street lighting.

—— The Wright Engineering Company has just installed a 25-light arc plant at the coal wharves of Jordon & Company, Boston.

—— The San Angelo (Tex.) Electric Light Company, recently formed, are busy setting poles and stringing wires for their main lines.

—— W. S. Hayer, formerly agent for the Edison Electric Light Company, in Wilmington, Del., has removed to San Francisco to fill a similar position.

—— The International Telegraph District and Call Company, of Baltimore, Md., have put in additional incandescent electric light machinery, with capacity for 500 lights.

—— It is said that the Thomson-Houston Electric Light Company has bought the Seneca Falls and Waterloo street railway for the sum of $6,700. It will be equipped and run by electricity, and is to be in operation before January 1st.

—— At the annual meeting of the electric light company, Thomaston, Conn., Aaron Thomas was re-elected president, J. S. Eastwood, secretary and treasurer; directors, A. P. Bradstreet, A. M. Young, J. S. Eastwood, A Thomas and B. W. Pease, M.D.

—— The Electric Light Company at Portland, Me., will soon put in another boiler, engine and two more dynamos. There are 21 dynamos, nine of them being used for arc lights and 12 for incandescent lights. Seven large boilers, using 125 horse-power each, furnish the motive power for the engines.

—— The city council, of Mitchell, S. D., recently granted an exclusive franchise for an electric light plant to the Northwestern Electric Light Company, of St. Paul, the Thomson-Houston system to be used. The plant will be completed November 20th, with a capacity of 30 arc and 600 incandescent lights.

—— The committee on lighting streets, of Manchester, N. H., held a meeting last week and, as if to make up for their recent excellent exhibition of caution in locating lights, went to work and voted seven new ones, calling for an addition to the electric light expense account of about $1,100 for the ensuing year.

—— The electric lights in Baton Rouge have not been lighted for several days, and the streets have been in darkness. The managers of the plant explain that they are running on moon schedule, and this is the time for the moon to show up. But the perverse moon, says the *Advocate*, continues to refuse to shine in spite of the dictum of the almanacs.

—— The Thomson Houston Electric Company reports the following sales of incandescent apparatus to local companies: Leominster, Mass., 650; Waltham, Mass, 650; Carlisle, Pa., 1,300; Bradford, Pa., 650; Franklin, Mass, 650; Passaic, N. J., 650; Mt. Vernon, Md., 650; Lancaster, N. H., 650; Atchison, Kans., 650; Vicksburg, Miss., 650; Santa Cruz, Cal., 650; Peoria, Ill., 1,300; Watertown, Wis., 650; Mason City, Iowa, 300; Pana, Ill., 650.

KINDRED INTERESTS

The Pond Engineering Company.—We have just received the new and very complete illustrated catalogue of this company, containing a description of their system of steam plants for electric lighting and power. It sets forth, in a concise and interesting form the advantages of the company's popular methods of work.

W. H. Gordon & Company.—This new firm, which has opened offices at 115 Broadway, New York, starts in under the best auspices and with the announcement that all goods carried will be of the best quality. Standard testing sets, Simplex line wire and Wirt voltmeters are a few of the goods carried by this company. They now have in press a new catalogue which will soon be ready to send out.

The Standard Paint Company.—The "P. & B." insulating compound is in great demand, the Standard Paint Company, of 59 Maiden Lane, this city, which controls this valuable insulation, being greatly rushed with orders. The "P. & B." is much used in wires and cables, and meets with commendation in all directions, and was highly complimented in the last report of City Electrician Walker, of Philadelphia.

Jarvis B. Edson, 87 Liberty street, N. Y., reports business active and recent sales of his steam recorder as follows: Laird Brothers, shipbuilders, England; Inman Line, N. Y.; United States Light Department, N. Y.; Edison Illuminating Company, Brooklyn, two orders; Manchester Water Works and Pawtucket Water Works, eight; Pennsylvania R. R., two; Langham, Astor House, Marlborough, Gerlach, and San Carlo, each one, and seven to the National Transit Company, who now have over 55 of his steam recorders.

The Eclipse Wind Engine Company, Beloit, Wis., have just closed large contracts for power transmitting machinery with the Cincinnati Electric Light Company, with the Laclede Gas Light Company, St. Louis, and with the Detroit Electric Light and Power Company. The demand for Eclipse friction clutch pulleys, rope sheaves, friction cut-off couplings, stands, shafting, etc., is steadily increasing, fully testing the capacity of the works of this company.

The Williams Engine Works, another competitor for trade in steam engines, have just completed a model plant at Beloit, Wis., the equal of which can rarely be found in the United States. No pains nor expense has been spared in equipping it with all modern improvements and appliances. The plans for it were prepared by the Flynt Building and Construction Company, of Palmer, Mass. The character of the outfit may be inferred from the names of some of the firms who have furnished it. Among them are William Sellers & Co., Philadelphia; Brown & Sharpe Mfg. Co., Providence, R. I.; Pond Tool and Machine Co., Plainfield, N. J.; Hendey Machine Co., Torrington, Conn.; Prentice Brothers, Worcester, Mass.; Putnam & Sons, Fitchburg, Mass.; Niles Tool Works, Hamilton, Ohio, and Edward P. Allis & Co., Milwaukee. Overhead, high up, an electric crane moves mysteriously, lengthwise and crosswise the building, over a large area. This herculean mechanism will soon be picking up engines in their entirety, and placing them on cars behind locomotives that will whisk them out of the building and away to Detroit, St. Louis, and to other points where contracts have been recently made with electric light and power companies.

The Westinghouse Electric Company received the following orders for central station apparatus during the month of October: Allegheny, Pa. (city lighting), 3,000 lights; Havana, Cuba, increase, 3,000 lights; Nebraska City, Nebraska, 750 lights; Aberdeen, Washington, 750 lights; Weeping Water, Nebraska, 500 lights; San Angelo, Texas, 750 lights; New York, N. Y., increase, 9,000 lights; West Superior, Wis., 1,500 lights; Bethlehen, Pa., 500 lights; Evanston, Ills., 750 lights; Independence, Iowa, 750 lights; Nanticoke, Pa., 750 lights; East Albany, N. Y., 750 lights; Florence, Ala., 500 lights; Corning, Iowa, 500 lights; Bay City, Mich., increase, 750 lights; Sedalia, Mo., 750 lights; Pittsburgh, East End, increase, 3,000 lights; Little Rock, Ark., increase, 750 lights; Fulton, Mo., 750 lights; Connellsville, Pa., 1,500 lights; Anoka, Minn., 750 lights; Canton, China, sold through San Francisco agency, 1,500 lights; Newark, N. J., increase, 750 lights; total, 34,750 sixteen candle-power lamps capacity. Also the following orders for arc apparatus to be applied to central station lighting were entered: Williamsport, Pa., 250 lights; Pittsburgh, Pa., E. E. increase, 175 lights; Florence, Ala., 35 lights; Evanston, Ills., 70 lights; Baltimore, Md., 35 lights; Philadelphia, Pa., 105 lights; Chico, Cal., 35 lights; total, 705 lights.

The Thomson-Houston Electric Co. report the following list of sales for the month of October, 1889: Burlington Gas Light Co., Burlington, Ia., 50 arc; O'Donnell, Spencer & Co., E. Saginaw, Mich., 200 incandescent; Natchez Gas Co., Natchez, Miss., 300 alternating; A. Zeese & Co., Chicago, Ill., 50 incandescent; Columbus Electric Light & Power Co., Columbus, O., 100 arc; Kearney Paper Mill, Kearney, Neb., 50 incandescent; B. Nugent & Bro., St. Louis, Mo., 35 arc; Balatka Bros., Chicago, Ill., 6 arc; Williams & Jerrems, Chicago, Ill., 35 arc; Barnum & Richardson Mfg. Co., Chicago, Ill., 6 arc; Armour & Co., Chicago, Ill., 70 arc; Adrian Electric Light Works, Adrian, Mich., 45 arc; Roberts & Griffiths, Chicago, Ill., 50 arc; Sioux Falls Electric Co., Sioux Falls, South Dakota, 50 incandescent; B. F. Draper, Ligonier, Ind., 30 arc; Springfield Electric Light & Power Co., Springfield, Ill., 50 arc; Ionia Electric Co., Ionia, Mich., 30 arc; Ottumwa Railway, Electric & Steam Co., Ottumwa, Ia., 75 arc, 1,300 alternating; C. C. Perry, Indianapolis, Ind., 1,000 incandescent; St. Charles' Block, Denver, Colo., 800 incandescent; Oshkosh Electric Light & Power Co., Oshkosh, Wis., 30 arc; Rochester Electric Light Co., Rochester, Ind., 50 arc; St. Johns Mfg. Co., St. Johns, Mich., 30 arc, 650 alternating; Camden Electric Light & Power Co., Camden, Ark., 30 arc; Citizens' Electric Light Co., Wichita, Kas., 650 alternating; City of Chicago, Chicago, Ill., 210 arc; A. P. Gilmore, Chicago, Ill., 350 incandescent; total, 932 arc, 2,500 incandescent, and 2,900 alternating.

The Jordan Coupler.

The accompanying cuts illustrate a very neat and practical coupler designed for to be used on tow cars, for which a great demand is probable. The inventor is Mr. L. F. Jordan, of Boston, and in a very simple manner he seems to have met a growing want. In a train of electric cars the motor car is always brightly lighted with incandescent lamps, while the tow-cars usually present an unpleasant contrast with their old-fashioned oil lamps. The trouble heretofore has been in finding a suitable coupler to connect the cars.

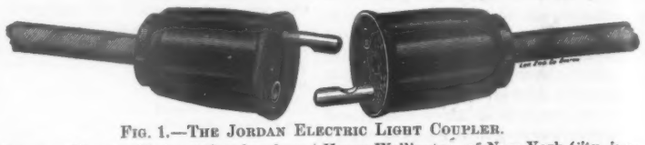


FIG. 1.—THE JORDAN ELECTRIC LIGHT COUPLER.

Mr. Jordan's device consists of two interchangeable couplers, one at each end of the tow-car, so that it is not necessary to run a car on to a turn-table and turn it round in order to use the coupler. When put together the two halves of the coupler form a water and air-tight gasket joint, no short circuit being possible through leakage of water into the coupler.

FIG. 2.—THE JORDAN COUPLER IN USE.

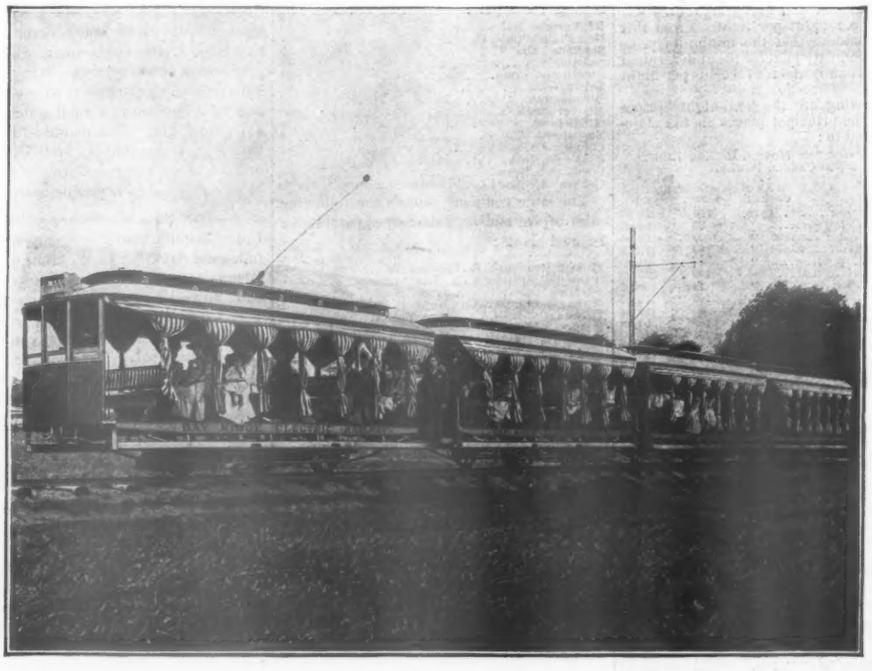
The West End road has equipped an experimental train of two cars with this device, which is in daily operation between Bowdoin square and Arlington. The tow car is brilliantly illuminated with five incandescent lamps. On the extremities of the roof of each car the cables to which the couplers are fastened are attached to a traveller with a run of about a foot and a half, thus avoiding stress on the couplers in rounding curves.

Henry Wellington, of New York City, is reported as stating that the running of the road is attended with the most pleasant and satisfactory results, and that it has been in daily operation, without the least cause of delay, since its installation.

Such results as these go far toward strengthening the already wide-spread feeling of confidence which street railway managers feel in their electrical equipments, and toward extending the use of electric roads in every State in this country.

—— The work at Pittsburgh of rebuilding the portion of the Westinghouse Electrical Works, destroyed by fire recently, has commenced, and will be finished in 60 days. Iron beams will replace the wooden ones, and the building is to be made fireproof, besides being enlarged. The improvements will cost $100,000.

—— The Eckington road, in Washington, D. C., has a new superintendent in the person of Charles W. Grant, a gentleman who has had a long and varied experience with electric machinery in the service of the Thomson-Houston Company. The president of the road never had any faith in the very common assertion that any intelligent mechanic can easily learn to run an electric plant, and a careful study of the elements necessary to make his road a success and keep it up to the march of improvements and the demands of business, convinced him that the constant attention of a man fully qualified to direct all details of the construction, operation and repairs of the electric appliances was one of them. Mr. Grant will also have charge of the Eckington incandescent lighting work which will be done with the Thomson-Houston alternating system.



VIEW OF THE ELECTRIC RAILWAY, BAY RIDGE, MD.

The Electric Road at Bay Ridge, Md.

The accompanying engraving is from a photograph, showing one Sprague electric car and three trail cars in operation on the Bay Ridge electric railway at Bay Ridge, Md. This road was installed during the spring of 1889, and has carried large crowds of passengers during the summer who have visited this popular sea-side resort on the Chesapeake Bay, near Baltimore.

Each electric car upon this line is equipped with two Sprague type No. 6 improved electric motors, and the regular average load during the past season has been its own full car load of passengers and one tow car similarly loaded. The photograph from which the engraving was made shows a test which was successfully made of forcing one electric car to tow three loaded tow cars, or three times the usual number of cars. While it is not advisable to overload electric motors, yet very often, when circumstances compel it, the motors can be relied upon to do more than the normal amount of work without any harmful results.

The management of this road have expressed themselves as being perfectly satisfied with their electrical equipment. The president of the railway company, Mr.

New Standard Resistance Box and Wheatstone's Bridge of American Manufacture.

An illustration of the large No. 1 standard resistance box and Wheatstone's bridge, made by James H. Queen & Co., of Philadelphia, as it has recently been improved, is presented in this issue of the REVIEW. This box is made after the design of Prof. Wm. A. Anthoney, late of Cornell University, and the claim is made that it is the largest, most complete and accurate pattern in the world. The general arrangement is that of Elliott Bros.' large "Dial Pattern," but the smaller details have been so modified as to make the set far more convenient to use and of a greatly increased range.

The coils in this set consist of 10 one-tenth ohm coils, 10 units, 10 tens, 10 hundreds and 10 thousands, giving an aggregate resistance of 11,111 ohms, and these coils instead of being set in circles, as in Elliott's form, are arranged in rows; this plan greatly aids in the cleaning of the rubber top, an operation of much inconvenience in the dial pattern.

The placing of these coils in rows instead of in circles also makes possible another use of this set which is one of its most valuable features, viz: a device by which the coils of each row may be connected either in series or in multiple arc at will and with equal facility; for example, taking the row of coils marked units, if we place a plug to the right of the block marked 0 and to the left of the block marked 10, we have a resistance of 10 ohms, while placing the plugs at the right of block 0, to the left of block 1, to the right of block 2, and so on through the row, gives us the same 10 coils in multiple arc and consequently a resistance of one-tenth of an ohm. This not only allows us to easily compare the individual coils with the standard, but is of the greatest advantage in allowing us to compare them with one another; for instance, each one-tenth ohm may not only be compared with all the others, but also with the row of unit coils placed in multiple and so on through each row, thus making errors in the adjustment of the set well nigh impossible when the work is conscientiously and carefully done.

The bridge arms consist of 1, 10, 100, 1,000 and 10,000 ohms on each side; by a special device they may be quickly reversed by the simple change of two plugs, an operation only possible in the forms hitherto used by the change of wires from one set of binding posts to another, during which time there might occur changes of temperature or other conditions sufficient to make the two measurements worthless for purposes of comparison, to say nothing of the inconvenience.

One of the most valuable as well as one of the most novel features of this set is the method of determining its temperature, a device for which has been lately added. As all those who are accustomed to the use of standard coils are well aware, there is always considerable doubt as to whether the temperature of the box, as indicated by a thermometer, is actually the temperature of the coil themselves, imbedded, as they are, in masses of paraffine, through which temperature changes take place very slowly. There is also the probability of a slight change in the thermometric reading before it is noted, as usually the thermometer is removed and quickly read in order to avoid the inconvenience of the stooping over. To obviate these difficulties, Prof. Anthony has made use of an extra coil, which he calls a "temperature coil." This coil is wound of copper wire whose temperature co-efficient has been carefully determined by several measurements made while the coil is immersed in water at different temperatures. Then, since the temperature co-efficient of copper is higher than that of platinoid, with which the rest of the set is wound, the apparent resistance of this temperature coil, measured in terms of the coils of the set, will rise or fall as does the temperature. In this way the change of temperature from the standard temperature of the set can be readily computed. To be more specific, the temperature

NEW STANDARD RESISTANCE BOX.

co-efficient of copper is 0.004, while that of platinoid is 0.00024, which gives a difference of 0.00376 as the co-efficient on which the copper coil will increase or decrease in apparent resistance, *i. e.*, measured in terms of the platinoid, for each degree centigrade change of temperament. If now the coil is wound so as to measure 266 ohms at the standard temperature, it is evident that a change in its apparent resistance of one ohm will mean a change of one degree in temperature, while fractional changes of resistance will indicate the same fractional changes of temperature. This, it is obvious, gives us a far more accurate means of determining the temperature than is possible by use of a thermometer, as we can, as is well known, measure $\frac{1}{1000}$ ohm resistance with considerably greater percentage of accuracy than we could $\frac{1}{10}$ degree centigrade by means of a thermometer, while we are very sure that we are measuring the temperature of the coils themselves and not that of the air outside of the coils. This temperature coil is conveniently placed among the other coils and connected in such a way that by simply throwing over the copper strap at the right hand lower corner into the adjoining post, the coil takes the place of the usual unknown resistance and is measured immediately without any further change of connections.

In this set, as it has been improved, have been made a number of changes in the minor details; the exact size and taper of the plugs has been carefully reconsidered and changed so as to insure a more perfect fit and contact, while small things, such as the most convenient proportions of plug tops, etc., have not been neglected.

The coils of this box are all being wound of platinoid wire, which has a very high specific resistance and the low temperature co-efficient of 0.00024, thus making the resistance changes, due to small changes of temperature, smaller than the usual accidental errors of measurement when the work required is not of the most accurate character. They are adjusted by Prof. Anthony himself, and compared with a standard coil which has been tested by the Cavendish standards and when differences from the latter are known. All the coils above one ohm are within $\frac{1}{1000}$ per cent. in accuracy, the one ohm coils within $\frac{1}{10}$ per cent., while the one-tenth coils are within about $\frac{1}{10}$ per cent. Prof. Anthony furnishes his own personal certificate with each set.

The set measures about 21½x13½ inches on top and is of the very finest workmanship throughout; the rubber top is of the very purest quality and ¾" thick, while the brass blocks and strips are of more than ordinary thickness, so as to entirely obviate any error due to their resistance. College and commercial electrical laboratories, doing large quantities of accurate testing and desiring a thoroughly reliable and convenient standard to which to refer, will find this set to answer perfectly all their requirements. Two have recently been purchased for the new electrical engineering laboratory of Princeton College, one is in the hands of the Chicago Edison Company for use on their underground circuits, another at the Ohio State University, one has been sold to the California Electric Light Company, etc. Prof. B. Thomas, professor of electrical engineering at the Ohio University, says: "It has all the advantages of the dial arrangements, and has in addition the advantage of the possible connection of any single coil, or of almost any desired combination of single coils, and also of any desired combination in parallel. One can, therefore, check the adjustments of the several coils against one another, the box thus containing the means for its own verification—an advantage not possessed by the ordinary arrangements. The box answers also the purpose of a set of comparison coils, and enables one to do a number of things beside, which can not be done with the usual forms. It adds not a little to one's satisfaction in using this fine piece to know that we owe it wholly to American ingenuity and skill, and that it adds one more to the list of things which foreigners who would have the best must come to America for."

Queen & Company also manufacture a number of other resistance sets of ranges and prices below this and forming part of a regular series which they hope soon to complete so that there will no longer be any necessity for going abroad for these necessary accessories to electrical measurement and practice.

VIEW OF THE ELECTRIC RAILWAY AT OMAHA.

The Electric Railway at Omaha.

The Omaha Motor Railway at Omaha, Neb., which is shown in the accompanying cut, is one of the largest and most important electric railways in the West. Seven miles and a half of track was the original electrical equipment, but the satisfactory operation of the cars resulted in its extension being made very soon after the first car was put in operation. In constructing the overhead line the cross suspension method was used, the conductor being supported from cross wires attached to poles placed at the curb line a distance of 120 feet apart. The track is laid with Johnson girder rail with some exceptions in the outlaying districts where the streets are as yet not paved; in these places T rail is employed. All the rails are reinforced at the joints by copper wires, insuring a perfect path for the return current. The line combines many grades and curves, the former ranging from three to nine per cent., and the latter being from 60 to 75 foot radius.

The power station is a two story brick building, with a small car house attached. The upper story is used for offices, store rooms and repair shop, and the lower story contains the steam and electrical apparatus. The building is lighted by 70 16-candle power lamps, the current being supplied from the same generator that furnishes current for the cars. The electrical plant consists of eight 80 horse-power Thomson-Houston generators, connected to a switchboard provided with all the most improved appliances necessary for the manipulation of the current.

The steam plant consists of two Corliss engines of 200 and 400 horse-power respectively, connected to a line of shafting provided with friction clutch pulleys, which renders each generator independent of the others. The boiler room contains six 100 horse-power boilers, steam pumps, heater and other necessary appliances.

The cars, which were built by the Pullman Company, are 26 in number, and are each equipped with two 15 horse-power motors. The average car run is 13 hours per day, and the average number of tow car trains per day is 23. There are three car houses capable of holding 100 cars located at convenient places along the line. Each is provided with suitable pits between the tracks so that the cars can be cleaned and all necessary repairs readily made, while, to facilitate shifting, a trolley wire is placed over each track.

The Omaha Motor Railway system comprises 40 miles of track, about 26 of which is equipped electrically. The traffic since the electric cars were used has been very heavy indeed, and the performance of the apparatus under severe tests with heavy loads has been all that could be asked. The electrical equipment will be extended as rapidly as possible until the entire system can be operated without the use of horses.

Accumulators at the Paris Exposition.

The official list of prizes distributed to exhibitors shows the following awards:

"Grand Prize."—M. Gaston Plante (deceased).

"Gold Medal."—The Société L'Eléctrique, of Brussels, who manufacture the Julien accumulators.

"Silver Medals."—The Electric Power Storage Company (E. P. S., of London), which exploits the Faure-Sellon-Volckmar accumulators.

"Silver Medal."—To the French Société of Accumulators (Phillipart Bros.), who exploit, in France, the Faure-Sellon-Volckmar accumulators.

Silver medals were also awarded to M. Gadot, who also exploits the Faure-Sellon-Volckmar accumulators in France, and to M. Emile Regnier, who exploits accumulators of his own system.

The other manufacturers of accumulators obtained either bronze medals or honorable mention.

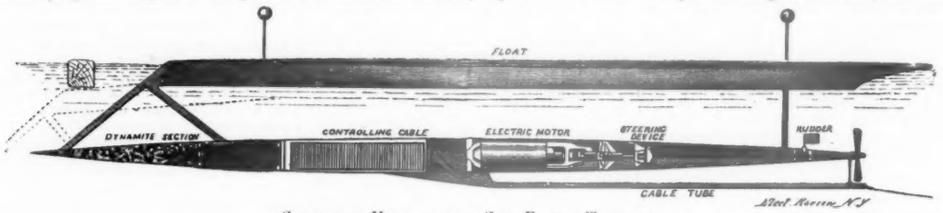
* * The Electric Railway in process of construction at Wooster, Ohio, will be in operation by January 1st, 1890.

The Sims-Edison Fish Torpedo.

FULL DESCRIPTION OF THIS INTERESTING AND VALUABLE INVENTION IN WHICH ELECTRICITY IS THE KEY OF SUCCESS.

This invention has now taken its place as the most perfect and reliable of all torpedo appliances. Years of costly experiment have been devoted to it, and to those interested in electrical progress it is gratifying to note that its success is entirely due to the ingenious applications of electrical energy to the various functions to be performed in service. A dynamo in a safe position on land, an intelligent officer with finger on steering keys, a light cable connecting these with the torpedo, and away out on the water nothing to be seen but two tiny guiding targets and a white splash darting along the surface; yet beneath the surface the deadly torpedo swiftly drives towards the enemy with a certainty of result which is due to the adoption of electricity as the motive power and guide of the apparatus.

As will be seen in our illustration, the apparatus as designed by Mr. W. Scott Sims consists of two parts, the "float" and the submerged "fish." A steel frame connects the two, being inclined at the bow and very sharp, so as to either cut through obstructions, or dive under them, as indicated by the dotted lines in the cut. Both the float and fish are of sheet copper, the former being filled with buoyant material and the latter carrying the explosive charge, the cable, the electric motor and the steering gear. These being six feet under water are safe from damage by the enemy's fire. The lines of both float and fish are beautifully modeled for the highest speed. Two spring-hinged uprights on the float afford the officer in charge a convenient means of guiding and setting the course.



SECTIONAL VIEW OF THE SIMS-EDISON TORPEDO.

The arrangements and working parts are as follows: The "fish" has four compartments with water-tight bulkheads, and, as each compartment is separate from the others, it can be taken apart when necessary for storage, and can be put together in 15 minutes ready for immediate service. The forward compartment carries the explosive. This will probably be the new material known as Emmensite, on account of its extraordinary power, safety and freedom from deterioration. The "one mile" fish will carry 250 pounds (said to be equal to 500 pounds of No. 1 dynamite), and the "two-mile" fish 500 pounds (equal to 1,000 pounds of No. 1 dynamite). The next compartment is vacant. The third carries the cable. To keep weights down to the lowest notch, a reel is undesirable, and to permit a coil to be used without risk of tangle, the cable is ingeniously wound into a hollow coil in such manner that it pays out finally absolutely limp and free from all torsional strain. Hence no tangle can occur, and the paying out from the boat itself avoids the loss of power which would follow the dragging of the cable from a reel on shore, besides preventing damage to the insulation. The fourth compartment carries the electric motor and steering gear. The screw, 50" diameter, revolves at speed of 750 to 800 revolutions, being geared down from the motor, whose speed is 1,500 to 1,600.

In its present improved form, the Sims-Edison torpedo is the most powerful and speedy submarine boat in the world, as can be seen by inspecting its data:

Weight total ready for service.....5,000 lbs.
" of motor (40 horse power) 764 "
" " 6,000 feet of cable.... 600 "
the remainder being distributed in the float and fish structure, exploding charge, steering gear, propeller, etc.

The cable is compound, having a small insulated conductor in the center for the steering current produced by a battery on shore, and an annular conductor for the motor current. This cable has an unusually high insulation, having repeatedly been subjected to a tension of 24,000 volts without damage, the tests being verified at the time by a Thomson electrostatic voltmeter. The main insulation is in five superposed layers. Even one of these layers by itself was not pierced at 12,000 volts. Probably the insulation would stand a higher tension than 24,000 volts. Resistance of 6,000 feet of cable, six ohms. It is interesting to note that this splendid cable is made in this country. Imported cables heretofore used have invariably failed in keeping qualities.

The motor and generator are both of Edison make. The motor is two-pole, series wound and its resistance at rest is 6.53 ohms. The generator is an Edison "Municipal," 1,500 to 1,600 revolutions, 1,300 volts at terminals and 25 amperes normal capacity. The motor at full speed absorbs about 1,150 volts, which at 25 ampers of current develops mechanically about 33 h. p., available for propulsion. Some sacrifice of efficiency of transmission has had to be made to keep the weights at a minimum. The cable, having six ohms resistance, absorbs 3,750 watts and the motor about 4,000, a total loss of nearly 8,000 watts—say 10 h. p.—in overcoming resistances.

Notwithstanding this, however, the motor on the official trial drove the boat at a speed of over 21 miles per hour, and on short runs reached 22 miles per hour. When we consider that this means a speed of over 30 feet per second, we can realize how difficult it would be for an enemy's guns to be effectively fired at the boat. The float in a "one-mile" boat is 30 feet long by 24 inches beam, while the boat or fish is 30 feet long by 20 inches diameter. Such an object at full speed is almost impossible to hit, and even if hit no worse damage can happen than a slight decrease in the buoyant power of the float. The torpedo proper is invulnerable because inaccessible under the water.

Steering is effected by a powerful electro-magnet, into which is switched the main current by means of a strong polarized relay actuated by the current of the shore battery through the central conductor of the cable. Two keys, or one pole-changing key and switch, under the hand of the officer on shore, control the relay in the fish, and the rudder is thus thrown to one side or the other at will, at any moment. The result is that while at full speed, the boat may have its course changed in any desired direction at any moment. Every conceivable evolution can thus be performed, and the boat far more skilfully and intelligently maneuvred than if a pilot were aboard directing its movements from a position which would necessarily be low down and command but a limited range of vision.

Spars and other debris are no obstacle. On the official trials the boat has dived under them and been guided onwardly as if nothing had opposed its course.

The charge is exploded electrically, and hence there is no probability of premature discharge. The moment when the boat has reached, and is pushing against the hull of the enemy, can be exactly determined day or night by a simple ammeter in the circuit showing by its great change of reading when the motor is affected by the stoppage of the boat. The *tout ensemble* of the Sims-Edison torpedo is of the simplest possible character. The best of material is used in every detail. The admirable arrangement and principles of operation of the various electrical devices renders it practically certain that each of them may be fully relied on to do its duty at all times.

Besides the many advantages possessed by such a torpedo for coast and harbor defence, it has a special value as an instrument of offensive warfare on the high seas. Every war vessel of modern construction is fitted with dynamos and engines for them. By carrying a generator for torpedo service, each vessel in commission can have one or more of the Sims torpedoes fastened by 100-foot hawsers furnished with electro-magnetic snap-hooks, the electric cable connection being then maintained permanently with the generator. The torpedo can thus travel along within a convenient distance, controlled by the pilot of the war ship. No supplies are to be replenished, and with proper lubricating arrangements a voyage of almost indefinite length may be made without once taking the torpedo out of the water. In action the war vessel could approach the enemy within a distance of two miles, stop, and send the torpedo on ahead guiding it to the certain destruction of the hostile vessel. Evidently this maneuver is possible without stopping the war vessel, as if necessary it is quite practicable to construct the Sims fish-torpedo for a speed of 25 to 30 miles an hour or even higher. But the opinion seems to be general among our U. S. engineer officers that a 20 mile speed is sufficient for all purposes.

A netting is no protection against such a boat. For when the netting is reached, if it is not at once cut through or passed under, it stops the torpedo, the fact is at once indicated by the instruments to the officer in control, and he touches the firing key and explodes the charge. General Henry L. Abbot, Lieut. Col. of Engineers, U. S. A., gives it as his opinion that a 400 pound charge of dynamite at good depth, if exploded at a lateral distance of 31 feet, "would disrupt a double cellular iron war ship." If so, 500 pounds of Emmensite would probably disrupt the hull at a distance of 50 feet and damage the machinery seriously if exploded at a distance of 100 feet. Hence a netting would be of little account, were the higher and safer explosive used instead of dynamite.

Such a torpedo boat is vastly superior from every aspect to the modern spar-torpedo-boat, which carries a crew, and must be of considerable size, and affords a large target for the terrific fire of modern rifled guns. It is better in every way than the self-propelling torpedo impelled by gas or air stored on board. Even the famous Whitehead torpedo suffers by comparison with the Sims fish, because of the uncertainty of its course, the impossibility of recalling once started, and the very low range—about 1,500 feet. The perfect control of the Sims fish, the ability to recall it or make it pass around the enemy and strike him from the rear, and the very long effective range (two miles) attainable, coupled with its indestructibility, makes it the most formidable and best torpedo in the world. Ten of the Sims fish torpedoes are now in store by the U. S. Government at Willett's Point.

And these merits are all due to the adoption of electricity as the source of power and transmitting it from a stationary generator by cable to the torpedo-motor. It is something for the electrical fraternity to be proud of indeed.

FOR SALE.—One 150 Incandescent Light Dynamo, standard make. Address
No. 510 WEST 7th STREET,
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FOR SALE.—A manufacturing business of Patent Electrical Machine. Big profits, and can be greatly extended. Established two years. Good opportunity for an energetic business man with small capital. Address
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ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON NOVEMBER 6, 1889.

414,191 Electrical regulating apparatus; Henry J. Conant, Watertown, Mass.

414,220 Electric battery; Chas. A. Hussey, New York, N.Y.

414,222 Tower wagon for electric street car service; Thos. L. Johnson, Cleveland, Ohio.

414,245 Ring armature for electric generators; Gustav Pfaunkuche, Hartford, Ct., assignor to the Schuyler Electric Light Company, same place.

414,266 Iron card induction coil for alternating current transfer; Elihu Thomson, Lynn, Mass., assignor to Thomson-Houston Electric Company, of Connecticut.

414,288 Machine for the manufacture of secondary battery slates; Hiram H. Carpenter, Denver, Colorado.

414,289 Switch for electric motor trolleys; Will Christy, Akron, Ohio, assignor of one-half to James Christy, same place.

414,293 Electric signal and brake device; Joseph F. Cox and Chas A. Cox, Louisville, Ky.

414,308 Electric burglar alarm; Albert A. Goucher, Euclid, Pa.

414,310 Electrical resistance indicating device; Chas. D. Haskins, Brooklyn, N. Y., and Charles E. Scribner, Chicago, Ill., assignors to Western Electric Company, of Chicago, Ill.

414,317 Battery carbon. 414,318 Electric battery; Charles A. Hussey, New York, N.Y.

414,327 Conduit for electric wires; John W. Richards and Joseph B. Hall, Newark, N. J.

414,339 Time recording device for dynamo electric machines; Hollon G. Spaulding, Boston, Mass.

414,418 Electric train brake system; Harry W. Leonard, Chicago, Ill.

414,422 Galvanometer; Joseph E. Lockwood, Detroit, Mich., assignor one-half to Chas. B. Larned, same place.

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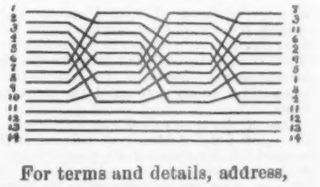

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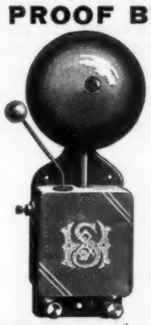

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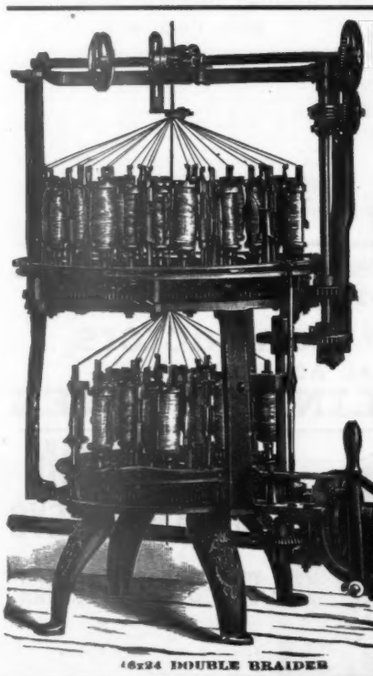

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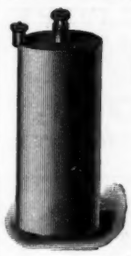

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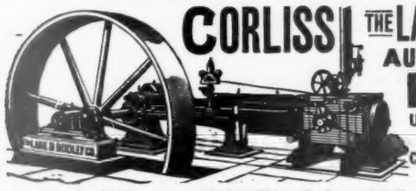

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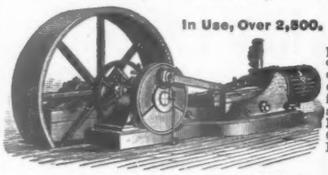

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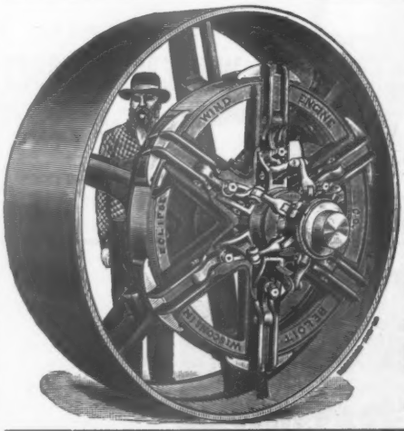

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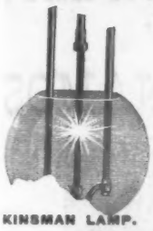
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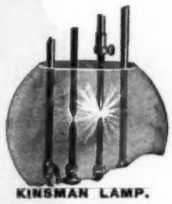
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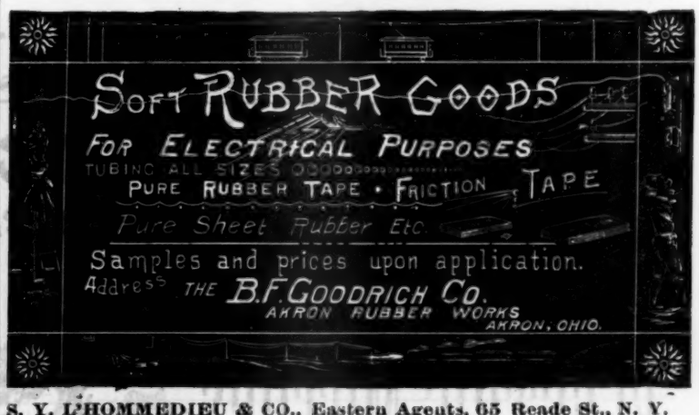

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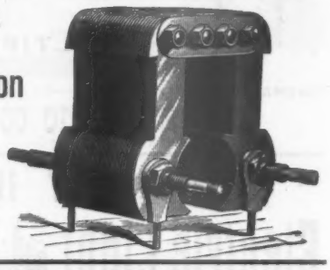

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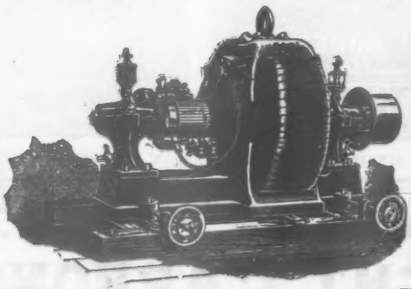

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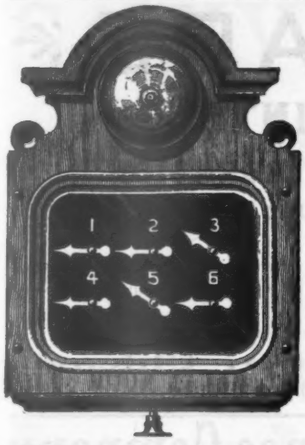

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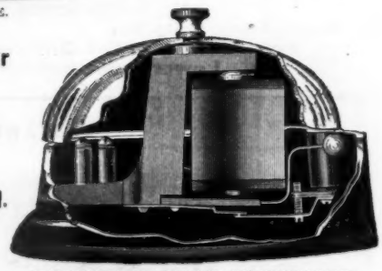

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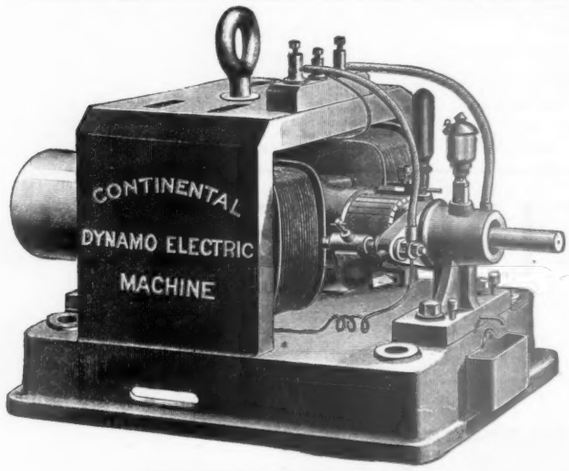

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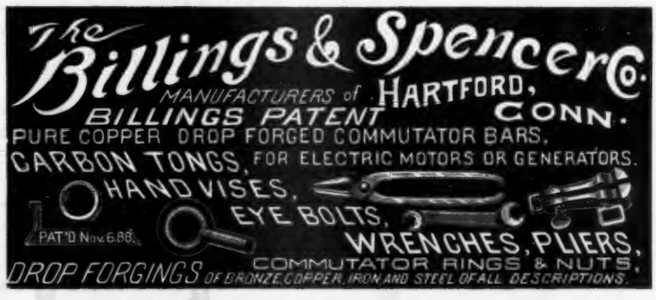
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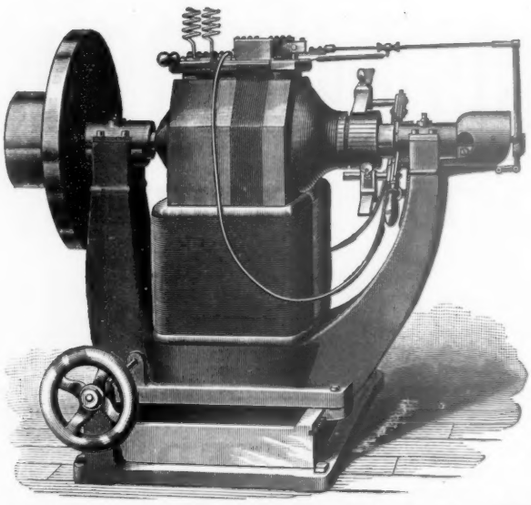

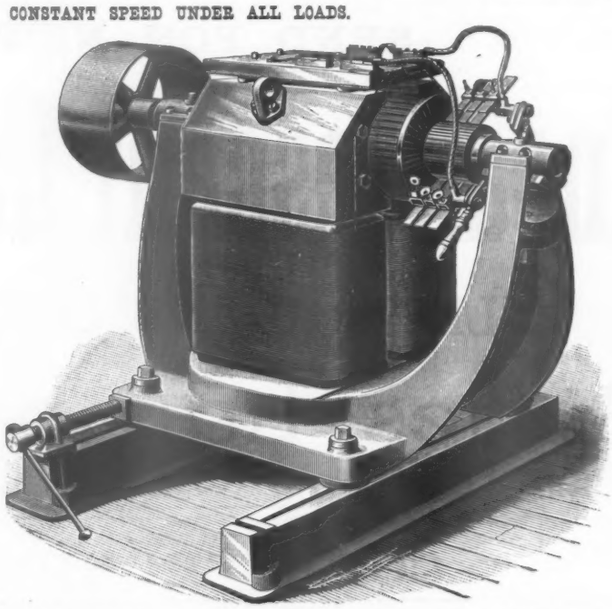

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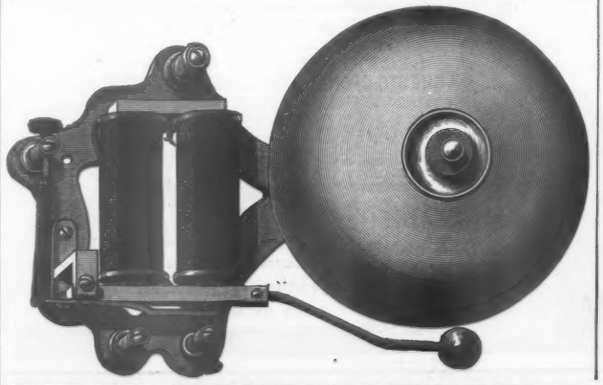

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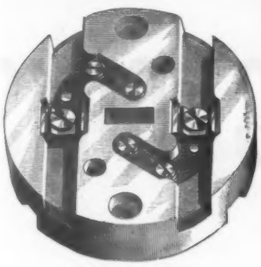

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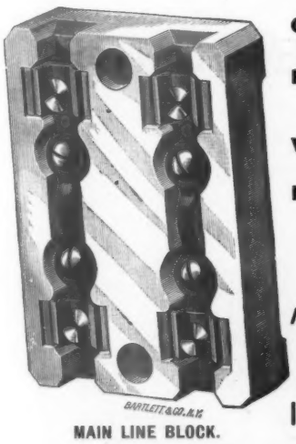

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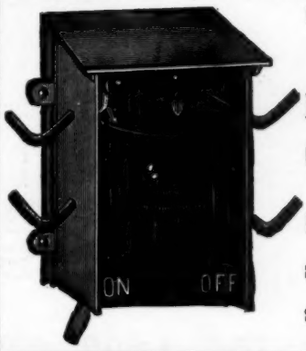

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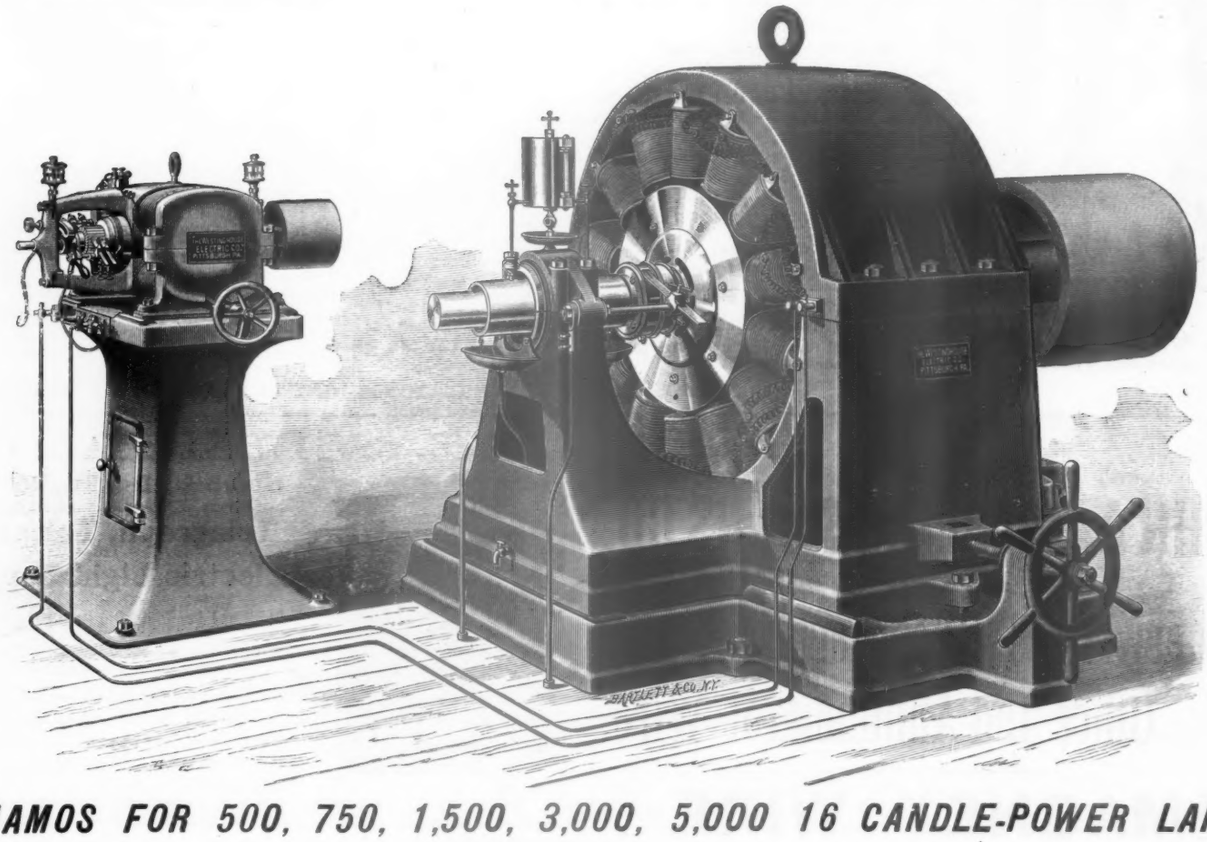

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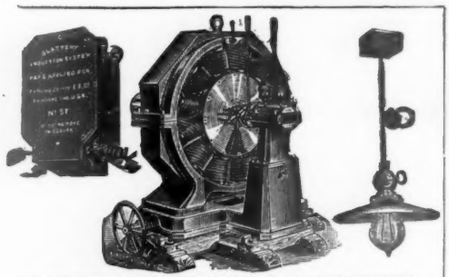

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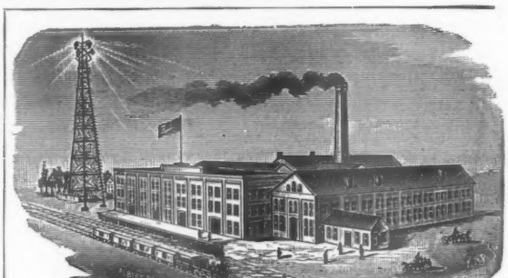

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